THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVIII. No. 1733.] LONDON, JULY 28, 1896. [48TH YEAR. PRICE 6d.

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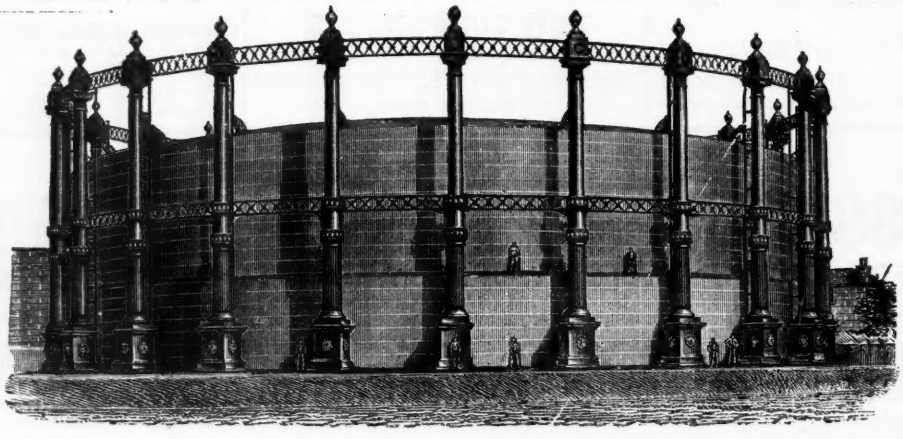

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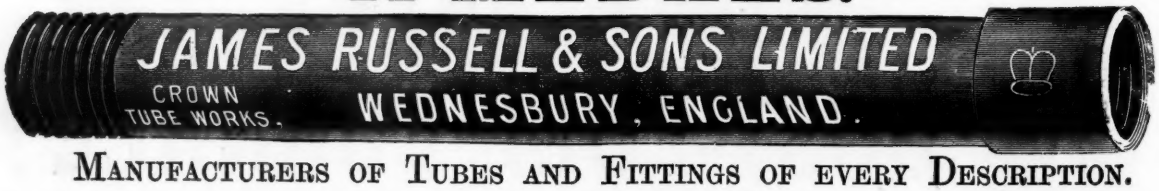

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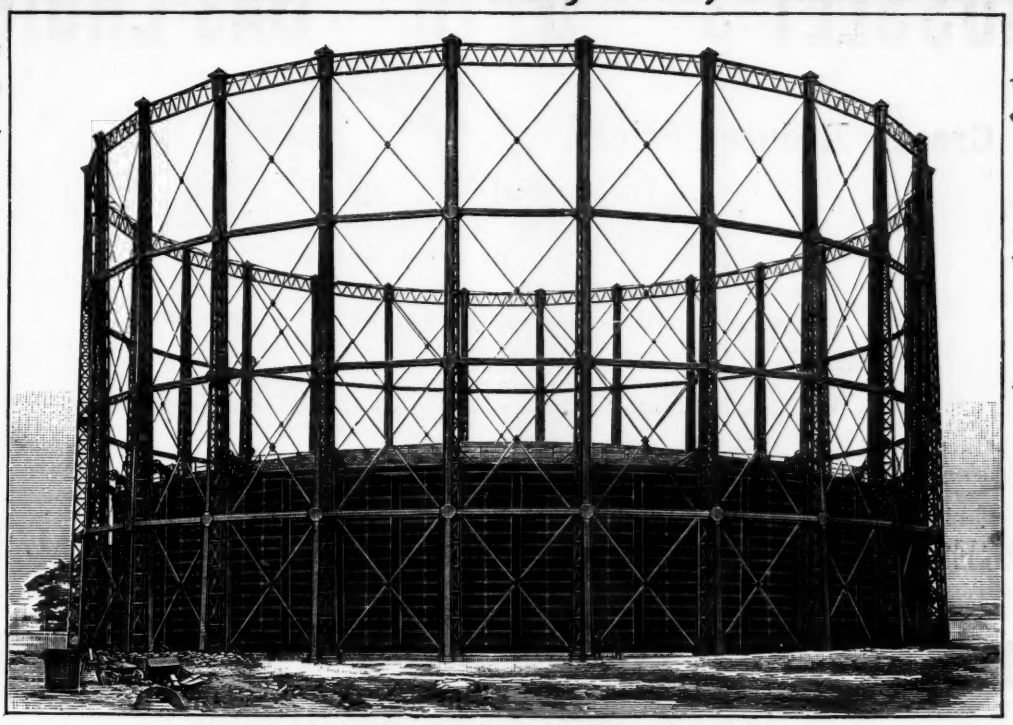

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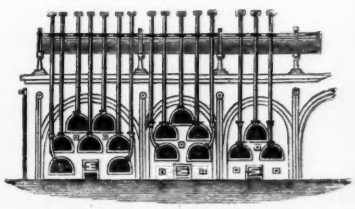

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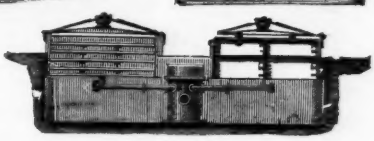

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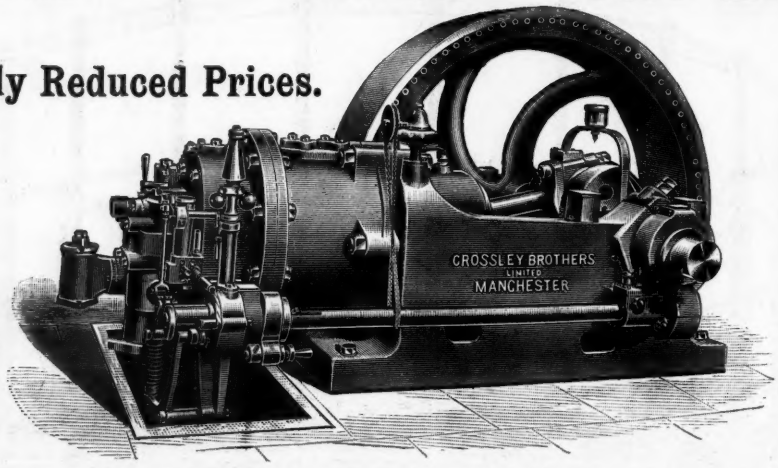

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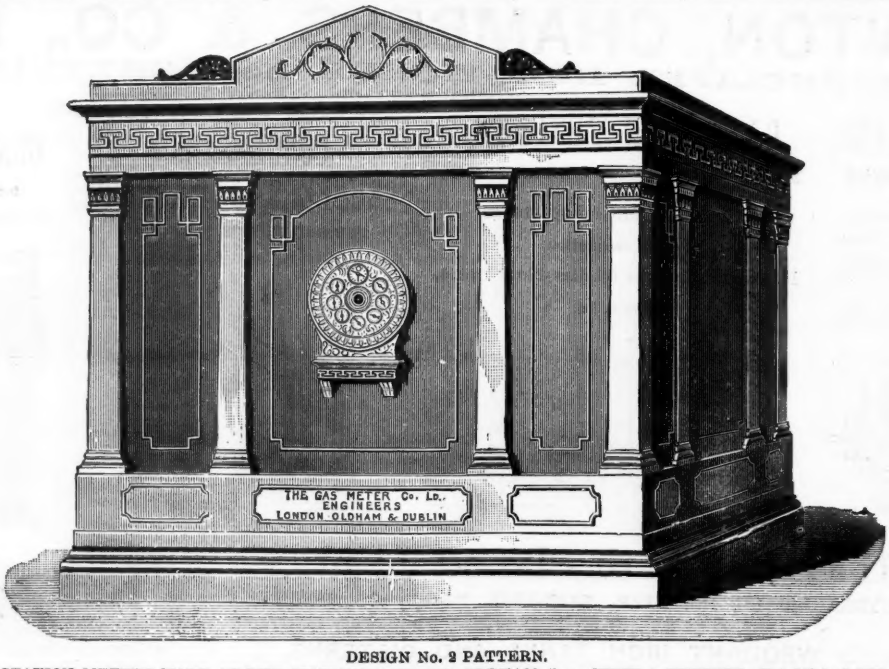

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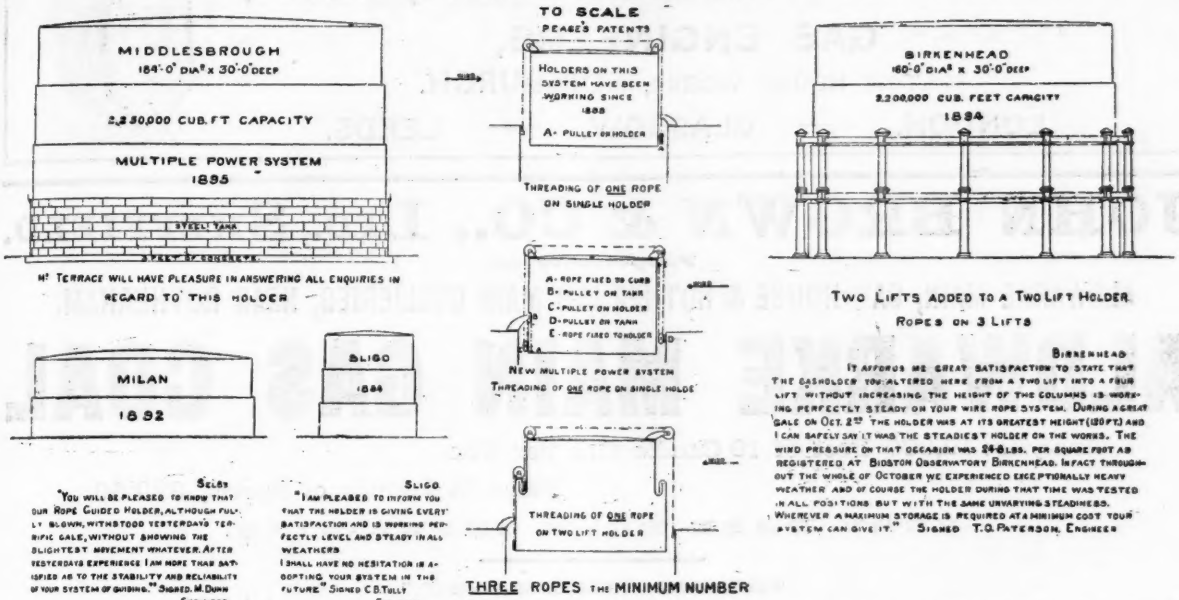

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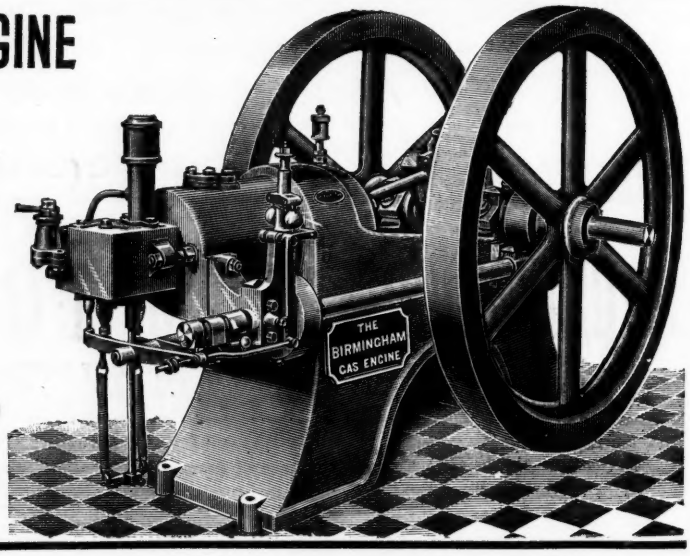

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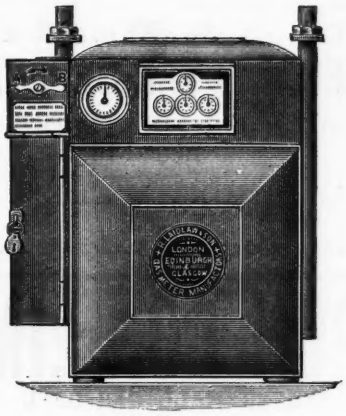

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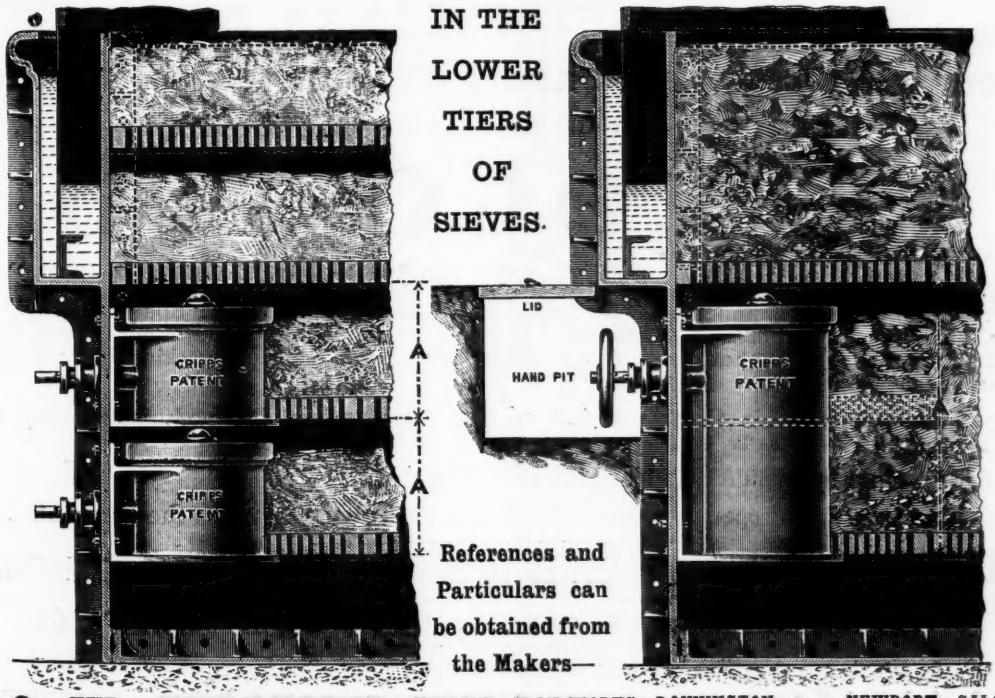

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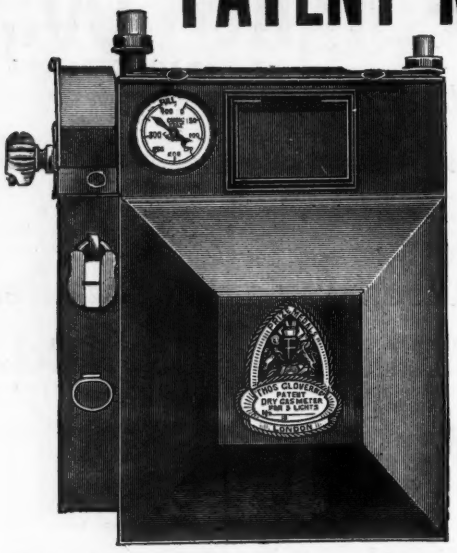

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[See also Advt. p. 196.

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EDITORIAL NOTES.

The North British Association Meeting.

THE members of the North British Association of Gas Managers met in Edinburgh last week, under the presidency of Mr. A. Yuill, of Alloa, whose Inaugural Address will be found in another column. This is a businesslike statement, closely connected with the work of the Association, and with the course of the gas industry in Scotland. For reasons which lie near the surface, the development of the Scottish gas industry is condemned to be slow in all but a very few of the fastest-growing commercial and manufacturing towns. Mr. Yuill complains that the use of gas-engines does not extend quickly in Scotland; and with regard to the local competition of the electric light, it is significant that the address does not lay so much stress as was formerly customary with speakers similarly situated on the competence of high-power cannel gas to distance all competitors. With regard to the manufacture of gas of the standard observed, among other places, in Alloa, Mr. Yuill roundly declares that carburetted water gas compares badly, in point of cost, with "gas made from coal "and oil in the ordinary manner." Gas of 28-candle power, put into the holder at a net cost, less residuals, of less than 10d. per 1000 cubic feet, if not a "record," is undoubtedly hard to beat upon its own ground. Nor is this Mr. Yuill's last word upon the subject. The datum just given was obtained with shale oil as the enricher. But by using blast-furnace oil it is promised that even better working results are obtainable. The proposal to resort to coal tar for carburetting is condemned by Mr. Yuill in uncompromising terms; and his observations on the whole question of gas enrichment are refreshingly candid and strong. The subject of automatic prepayment meters also engaged the President's attention; and it is as surprising as it is gratifying to learn that even in the Kingdom of Fife, where the "bawbees" are commonly understood to be made to go farther than they do anywhere else in the world, these conveniences are found in favour both with the cottager and the gas manufacturer. Like everybody else in the trade, Mr. Yuill is much disheartened when he regards the market price of sulphate of ammonia; but he sturdily refuses to entertain the pleasing yet baseless idea that the commodity is likely to rise in value. The address—one of the best to which the Association has ever listened—concludes with some very suggestive remarks concerning Mr. Yuill's own introduction of forced draught in connection with the working of gas-producers for retort-furnaces. The innovation was mentioned in an almost casual way in the address delivered by the same speaker at the "Informal" meeting of Scottish gas managers held in Glasgow in April of last year; and now Mr. Yuill is able to state that the plan has proved practically successful, and is being introduced into three gas-works this season. More should be heard of the matter on a future occasion.

The longest and, on the whole, most important paper read at the meeting was that by Mr. William Young, of Peebles, on "The Permanency of Illuminating Gas," the text of which appears elsewhere. This communication was a continuation of the same author's studies of the subject, of which the first instalment was published in 1874; and much of it is a review of the results of this line of investigation, as already made known. In re-stating the facts disclosed in these papers with regard to the conditions of permanency of the illuminating constituents of coal gas, Mr. Young leads up to the consideration of the behaviour of "oil mist or fog" in a current of such gas, which recalls our description of Mr. Botley's cure for the naphthalene nuisance. Mr. Young does not directly mention this device; but towards the end of his paper he discountenances the apparently similar, but really distinct, suggestion that "the addition of the *vapour* "of a liquid hydrocarbon to ordinary coal gas has the "property of, in some occult way, raising the vapour "tension of the hydrocarbons already held in diffusion "through the gas, and more particularly that of the vapour "of naphthalene." He is not altogether sure as to the naphthalene, it is true; because the fact of its passing straight from the vaporous to the solid form may entail other peculiarities of physical state in the presence of other hydrocarbon vapours. But he nevertheless holds that naphthalene carburetting is very much of a myth. He

thinks it just possible, however, that in some circumstances this constituent of gas may crystallize out in such a fine state of subdivision as to be susceptible of being carried onward in suspension in the current. How much carburetting value would attach to this infinitesimal naphthalene "sleet" does not appear. Although there is a very considerable amount of reservation about his conclusions, the sum and substance of these appears to be that the addition to coal gas capable of throwing down naphthalene, of quantities of the vapours of fluid hydrocarbons short of the point of their own saturation, has no effect in enabling the gas to carry its naphthalene any farther than it would go in the absence of such vapours. This contention is probably justified; but, of course, it is altogether beside the point of Mr. Botley's expedient. If Mr. Young wishes to arouse a lively discussion on the subject of naphthalene deposits, however, he must "come South," where the trouble is much better known than it is among his habitual hearers in the land of 28-candle gas.

The paper read by Mr. Henry O'Connor, describing some devices made use of by the author for simplifying the work of the photometer-room, is also well worth notice. For some time past Mr. O'Connor has been studying the problem of constructing photometrical apparatus which, without attempting to satisfy the exigencies of the Metropolitan Gas Referees, might yet serve the requirements of the majority of gas managers throughout the country. These studies are not yet completed; and consequently the technical world may hope to hear again on the subject from Mr. O'Connor at no distant period. But meanwhile the first-fruits of the author's labours, in the form of a set of diagrams for facilitating the making of the necessary calculations for standardizing photometrical readings, are given in the paper. Mr. O'Connor is also aiming at the production of a compensated meter upon a plan of his own, of which it can at least be said that the idea involved is as promising as the object is desirable.

The meeting was well attended, and the proceedings generally were of average interest; although, as usual, too much of paper reading and discussion, and formal business, was crowded into the one day appropriated to these transactions, with the deplorable result of preventing the full consideration of anything in the programme. The work of the Murdoch Memorial Committee is ended, not, unfortunately, by the attainment of the object primarily desired—the foundation of a University "bursary" to keep the name and memory of Murdoch prominently before the perpetually rising generations of Scottish students. There was no hope of getting together the money that such a foundation would require; and so it has been decided to spend the cash in hand upon a gas-engine, bearing a suitable inscription, to be placed in the Physical Laboratory of the Glasgow University, in connection with Mr. Andrew Stewart's munificent endowment of this institution. The chief other work of the Association for the past year has been done by the Committee appointed to consider the expediency of standardizing gas-meter unions. The practical outcome of the investigations of this Committee has been the production of a set of standard unions, which all the meter makers in Scotland have agreed to adopt as from the beginning of next year. It only remains to get the Board of Trade to endorse the Committee's selection; and this movement will form the subject of further correspondence with the Standards Department. We do not yet know how far the proposal to render the standards applicable to England will strike the trade and the chief users of gas-meters. The next President of the Association is Mr. Alexander Bell, of Dalkeith; and the place of meeting will be the good town of Ayr, of immortal reputation.

The State of the Coal Trade.

It is pretty generally believed throughout the Federated coal districts that the deadlock in regard to the continuance of the Conciliation Board is not going to precipitate a general strike or lock-out, inasmuch as the coalowners are not likely to take combined action to enforce the much-discussed 10 per cent. reduction of wages. Why such a reduction was ever mooted, if there was no intention of standing to it, is one of the mysteries of coalowning policy which outsiders cannot hope to fathom. The employers, or at any rate some of them, declared that without this 10 per cent. reduction of wages they could not keep their pits open. The miners were actually balloted as to whether they would consent to this docking of their rate of pay; and, very naturally, they refused to entertain the suggestion. Thereupon all the elaborate machinery of the Conciliation Board was understood to be thrown hopelessly out of gear; and after the expiration of the current week, employers are to face the future and each other as though there had been no Rosebery Settlement—yet nothing is going to happen! It reads about as impressively as an *opéra bouffe* plot. The question that has now to be asked is whether the associated employers were not secretly desirous of getting rid of the Conciliation Board, which was apparently powerless to conciliate, and only constrained them to meet, on nominally equal and amicable terms, professional labour agitators whose amenity was due to lack of power rather than of want of will to play the firebrand once more. Now at any rate the strong employers, or those who can make their business pay at the rates at which such typical gas coal contracts as those of Manchester and Leeds have been placed, are free from the embarrassment of artificial connection with their less fortunate rivals in trade. And if the latter in some instances are driven to demand that their workpeople shall take a lower rate of pay as an alternative to going without work altogether, the matter will have to be settled in the individual cases as they arise. There is an ominous silence on the part of Lord Rosebery and other public men with regard to the collapse of the Conciliation Board, and not a question has been asked in Parliament to clear up the mystery of its abandonment. The event goes to show how little value is to be attached to artificial attempts to vary the course of economic laws. When there has been a fight, and both sides have had enough of it, while it is doubtful which has won, the well-meant offices of a kindly mediator may be accepted as a means of patching up a settlement; but no guarantee can be obtained that the circumstances will continue as the mediator found them.

Curious Trade Union Dispute at Chiswick.

Those who are disposed to regard an omnipotent Trade Unionism as the sole and sufficient remedy for all the labour troubles that so easily beset the industries of this land of liberty and hard work, may be recommended to consider the case of Thornycrofts, just reported in the newspapers. Everybody knows how this Chiswick firm of torpedo boat builders and marine engineers have within the last few years created a speciality in their craft, closely connected with the development of the water-tube boiler. This description of boiler is, of course, of totally different construction from the ordinary marine boiler. It is composed for the most part of a mass of pipes, whereas the latter is made of plates riveted up into a shell. The difference of construction carries a corresponding difference of workmanship; for although the congeries of pipes now called a water-tube boiler is, in point of fact, as much a boiler as the other variety of the article, it takes fitters instead of platers and riveters to put it together. Consequently, the advent of the new type of boiler put the ordinary boiler makers' noses out of joint, so to speak; and over the Chiswick boiler yard, in particular, descended a great, though temporary, quiet. The man with the pipe-wrench and the ratchet-brace, the spanner and the cold chisel, found himself making boilers; while the orthodox, and, above all, organized and ticketed "boiler "maker" found this his avocation was gone. The course of the true Trade Unionist was clear, and was soon taken. The disestablished members of the Boiler Makers' and Iron Shipbuilders' Society turned a deaf ear—it is a frequent infirmity of theirs—to the promptings of everything but their immediate trade interest, and demanded that the fitters should be taken off the boilers, and replaced by duly accredited boiler makers. The employers naturally found this request extremely inconvenient; but, for the sake of peace, and because there was much work of the kind in the yard, they did their best to divide up the business of making the new type of boilers between the men of the two Societies, so that both should have a share of what was going. This equitable arrangement, however, did not work. As "The Times" reporter put it, "though the wages list did not decrease, very little result "was apparent in the shape of boilers produced; in fact, "the boiler makers and fitters were largely devoting their "energies to obstructing each other." The result was to stop the work for twelve weeks, while the Executives of the two Societies were vainly endeavouring to arrange terms for a reference of the difficulty to an arbitrator. By

last Friday week the firm had become tired of the dispute. A meeting was then held at which Messrs. Thornycroft declared they must get their work forward in some way. "As the fitters would go on strike if the boiler makers did "the work, and the boiler makers would go on strike if "the fitters did the work, and as both would strike if any-"body else did the work," there was no other prospect than that the work of the whole yard would be stopped indefinitely, unless every Society man in the place was turned out. We have not heard how matters have gone on lately in this distracted establishment; but the tale as now told carries a good "moral," in whatsoever way it may end.

The Lord Chief Justice and the "Malignant Canker."

A QUESTION has been framed by Mr. Hazell, M.P., to be put to the First Lord of the Treasury next Friday, as to whether his attention has been called to the corrupt commissions case in the Lord Chief Justice's Court; whether he is aware that this system of commercial bribery or secret commissions is widespread, "and in the existing "conditions of trade is likely to increase;" and, finally, whether a parliamentary inquiry will be held "in order to "ascertain the extent and the working of the evil, with a "view to remedial legislation." Such a question is not at all surprising or superfluous, in view of the revelations referred to, which, after all, only brought to light a few rather paltry instances of what all business men know to exist, even if they neither participate in nor wink at it. In common with everybody who desires to see trade carried on in the true spirit of commercial freedom—of "fair play "and no favour"—we should like to be able to believe that Mr. Hazell's query will bear speedy fruit. All the same, it is foolish to hope that this, any more than any other kind of offence that pays, in some immediate tangible form, those who commit it, can be suppressed by penal legislation, though a strengthening of the law may make it more hazardous. Weak humanity will always be prone to take short cuts to its objects, whatever they may be. It is impossible to withhold sympathy of a certain sort from a victim, as well as a practitioner, of the secret commissions system, who recently wrote to the "Ironmonger" to state an experience which is only too obviously true and typical. This man, a traveller in the hardware line, begins by remarking upon the easy part of those who moralize, as compared with the lot of those who have to practise morality if possible—but, at any rate, sell goods and make a living. He tells how hopeless is the task of getting an order from any large house on the merits of a commodity, unless he is prepared to do "the usual" for the buyer. This is the position as the "commercial man" puts it. He must grease the buyer's palm, or he gets no order; "but I have got to live." There's the rub. There is assuredly a very human note in the exclamation of this sufferer: "If the Lord Chief Justice were only one "year 'on the road,' with his wares right, his prices "right, his moral disgust at 'malignant cankers' right, "and, above all, with his living to get, he would learn that "there are many more things in earth than are dreamt of "in his commercial philosophy." Can one fancy such a figure as the Lord Chief Justice "on circuit" with such a purpose? His Lordship, as all know, has ever been a capital scolder of other men. But did he ever have to coax a British judge or jury, before his own elevation to the Bench which he so adorns, as a poor fellow "on the "road" has to wheedle a British shopkeeper for an order for a few knives and forks? We, at any rate, cannot find it in our heart to blame the sinner, although we must reprobate the sin, and approve of every well-considered plan for checking it, and especially for putting the temptation to it away from all those whose circumstances render them prone to yield.

WATER AND SANITARY AFFAIRS.

AT the present hour, it is not too much to say that the London Water Question is in the hands of the Metropolitan Water Companies, despite all the opposition and restrictions they have to endure. The Government Water Board Bill is withdrawn; and it is distinctly declared by the organ which more than any other represents the London County Council, that in respect to the supply from Wales "it will be impossible to prepare a scheme and Bills for "next session." The idea of buying the existing undertakings finds a vague kind of expression at Spring Gardens in a hazy resolution adopted at the instance of the Earl of Onslow, by virtue of which "a Bill or Bills," at present undefined, shall be prepared, so that somebody may be in a position to buy up the undertakings of the Water Companies. The further discussion of the Welsh project is adjourned until "after the recess." The annual address of the Chairman, given last Tuesday, is said to have created surprise by its friendly bearing towards the Water Companies, who are described in the columns of "London" as "the enemy," and as maintaining a position "defiant" and "hostile" towards the Council. We rather thought the Council were the assailants—the Companies standing on the defensive. Why should the Companies attack the Council? There is an evident inducement for the Council to attack the Companies. Sir Arthur Arnold desires a more amiable relationship, and is sanguine that the water question awaits a peaceable settlement. He has discovered that there is a great advantage in discussing the subject of purchase with each of the Chairmen of the Water Companies. Sir Arthur is perfectly correct in these views; but we apprehend there is a strong party in the Council which will love him all the less for being reasonable, and for having acquaintance with the aforesaid chiefs appertaining to the camp of "the enemy." The party already refuse to entertain his belief in the possibility of a voluntary agreement with the Companies, except such an agreement as the Council would not adopt. One opinion entertained by Sir Arthur may be popular at Spring Gardens. It is that, whether or not a Water Board is created, things will work round in such a way that in the course of five years the Council "will be, as it should be, the Water Authority "for London."

While the Council are thus amusing themselves with the notion that they are really dealing with the water question, the Bills of the Water Companies are passing through Parliament. The Committee of the Lords, with Lord Brougham and Vaux as Chairman (the Duke of Westminster having retired), have disallowed the *locus standi* of the Hertfordshire County Council, who had petitioned against the New River Company's Bill; and the Bill has accordingly become an unopposed measure, and now awaits the third reading. The Staines Reservoirs Bill has been proceeded with, and ordered to be reported to the House. Four Bills out of five brought in by the London Water Companies are thus in a fair way of becoming law. All that the County Council can boast of is that they have caused the powers originally sought for to be curtailed. The New River Company's Bill proposed the raising of £1,500,000 of ordinary capital, and £500,000 of debenture stock. The total amount has been fixed by the Committee at £390,000, to be raised as debenture stock, subject to a sinking fund. The capital to be devoted to the Staines Reservoirs scheme is fixed at £1,000,000 of debenture stock, redeemable in twenty-five years. The works proposed by the Southwark and Vauxhall Bill were estimated to cost £750,000; and the scheme stands postponed rather than rejected.

It is singular that Parliament should hold the Companies back from the execution of works which are designed to safeguard the Metropolis against the perils of a water famine, or the inconvenience of a short supply. If the Bill of the East London Company had been passed in 1893 instead of a year later, there can be no doubt that the unfortunate effects of the present drought in the Company's district would have been prevented, whatever may be said as to the experience of 1895. When the Bill was passed in 1894, the Company proceeded with the utmost energy and promptitude, and even with feverish haste, to carry out the works authorized by that measure. But the extraordinary drought of the present summer has baffled every effort; and the Company have been placed under the necessity of curtailing the supply. More correctly speaking, they are now giving an intermittent supply instead of one that is constant. The introduction of the constant service lies at the root of the mischief. When the new system was set on foot, house cisterns were extensively discarded; and now we hear a huge cry of distress because the water is only on for six hours out of the twenty-four. When the intermittent system was the rule, a flow of water into the cisterns for six hours per day was found to be ample. Of course, where there are no cisterns, the moment the supply stops there is distress, unless precautions have been adopted by the filling of every available vessel during the time of flow. The Company's officials allege that there

is an enormous waste of water in the East London district, which is possible enough with an immense population, largely of the industrial class. Even under the restricted hours, the daily supply amounts to 25 gallons per head. According to some sanitarians, this ought to be enough for any population; and certainly at the present moment there are a good many places in England where the people would be very glad to get such an allowance.

One broad question connected with this trouble in the East London district has reference to the parliamentary restraint laid upon the extension of works. A popular call has been made upon the East London Directors to buy water from the New River Company. The President of the Local Government Board has endeavoured to bring this plan of inter-sale into operation; but it has been found impossible to augment the East London resources in this manner. In view of such a fact, we may question the wisdom of Parliament in so cutting down the scheme in the New River Company's Bill as to reduce it to about one-fifth of the dimensions as originally proposed, when measured by the capital outlay. In future years, we may reckon that the East London Company will have to stand alone without a chance of rescue; the New River Company being left without a margin by which help might be given. Parliament evidently erred in setting the East London scheme aside three years ago; and on public grounds we may fear that it has erred on the present occasion in the restrictions it has imposed on the construction of new works by the New River Company. That this Company will be assisted by the Staines reservoirs would account for some curtailment of their project; but the process seems to have been carried too far. The New River and East London Companies each supply more than a million of the population, and the two together more than two-fifths of the whole. Such responsibility demands commensurate means. In dealing with the Metroplitan Water Question, Parliament has displayed especial anxiety to limit the capital account, when possibly there should have been a more complete appreciation of the main purpose which a Water Company is intended to serve.

The British Association of Water-Works Engineers held their first annual meeting at Nottingham last week, under the presidency of Mr. D. M. F. Gaskin, the Corporation Water Engineer; and, as will be seen by the report in another part of the "JOURNAL," much useful work was accomplished. The remarkable vigour which this new organization has shown is highly gratifying to the prime-mover in its formation—Mr. Gaskin—and those who so zealously supported him; and we heartily join in the congratulations which were liberally bestowed upon them during the meeting on the success of their labours. Brought into being at Nottingham so recently as Jan. 11 last, by the enrolment of the thirty-seven gentlemen who were present on that occasion, and with the promise of active support from sixty others, the membership already exceeds 130. At the outset, however, it is not so much to great numbers that the Council must look as to the addition to their ranks of further gentlemen whose accomplished work in water engineering has set them among the recognized leaders of the profession; for it is the inclusion of such distinguished men that will give to the Association the dignity that will command for it the respect and authority to which it aspires. From the first, the founders have held a lofty conception as to what the Association should be; and that they wish to maintain the standard they have in view is clearly shown by the constitution and rules they have framed and the work they have mapped out for the future. If the same spirit animates the whole of the members, the Association cannot fail to exercise a beneficial influence upon the water-supply systems of the country.

Little comment is needed upon the work which engaged the attention of the members at the meeting, as the excellence of its quality will be readily judged by our reports. The President's address was eminently suited to the inaugural meeting of the Association; and the studious labour which he must have devoted to its preparation richly deserved the spontaneous ovation which he received from the members at its close. The fact that the President wished to place on record in the Transactions an account of the development of the Society from its inception, and an explanation of its objects, made the address longer than it probably would otherwise have been. But as a contribution to the literature of the profession, it will be of much value, especially to the younger members. The concisely prepared particulars as to the Nottingham Corporation Water-Works with which the address closed were very serviceable to the members when visiting the pumping-stations on Wednesday. The nine papers submitted to the meeting were all meritorious compositions, and, with one exception, were all contributed by members. Four of them dealt with questions of engineering construction; and three with matters concerning the distribution of water. The remaining two were by recognized authorities on subjects the importance of which to the water engineer cannot be overrated; and they will therefore, when published, be read with more than ordinary interest. One was by Professor Frank Clowes on "The Interpretation of Results of the Chemical "Examination of Water;" and the other by Mr. C. E. De Rance, on "Hydro-Geology and Hygiene: Law and "Legislature." The papers were all subjected to critical examination; but the debaters are as yet limited in number. The same remark, it is true, may be applied to several older societies. It is to be hoped, however, that, as the members of the new organization become better acquainted, an effort will be made to induce a wider expression of opinion, so that the discussions may not become dependent on the few, and narrow in the survey of the subjects treated upon. Bearing upon the papers, attention may here be specially directed to the reference to the formation of Water Boards in the contribution of Mr. De Rance. "Looking to the complexity of the "existing water law, vested interests in the parliamentary "costs of obtaining the existing powers, and the far larger "capital expended in carrying out works so sanctioned," he is of opinion that decisive, but progressive, steps in legislation are absolutely necessary; and he ventures to suggest that county councils, or groups of them, should have powers given to them by Parliament to form Water Boards. A few large districts are, and have been for several years, satisfactorily supplied by combinations of the governing authorities; and there is evidence of a spreading belief in the wisdom of such united action. The Association are fully alive to the importance of this matter; and—one of their professed objects being "to assist the "Legislature, public bodies, and others," and "to "originate and promote improvements in the law, "and to support or oppose alterations therein in all "matters relating to water-works"—they have given due weight to the views advanced by Mr. De Rance, and have appointed a Sub-Committee who are charged with the duty of specially watching the progress of events in this direction, and of reporting thereon. The constitution of the Committee is sufficient guarantee that the work will receive earnest attention. In closing this notice of the proceedings, it must be said that the arrangements made for the meeting by the President, Secretary, and Council, were admirable, and not found wanting in any respect.

PERSONAL.

Mr. C. F. BOTLEY, son of Mr. C. E. Botley, Assoc.M.Inst.C.E., of Hastings, passed first class in the Honours Grade in "Electric Lighting" at the last technological examinations of the City and Guilds of London Institute. Mr. Botley is the Assistant Gas Engineer and Electrician at the Hastings Gas-Works, and is consequently striving to perfect himself in the details of both systems of lighting. He is to be congratulated upon his success; for to have gained the full technological certificate, he must have passed in several other subjects of the Science and Art Department. It may be remembered that, in association with his father, Mr. Botley has devised a process for carburetting gas with naphthalene, which was favourably noticed on the occasion of the visit of the Institution of Gas Engineers to Hastings in May last.

Mr. T. B. YOUNGER, who for about twenty years has been Manager of the Georgetown (British Guiana) Gas-Works, has relinquished his position and has returned to England. The severance of his connection with the Company was at his own request, as his engagement would not otherwise have terminated till the close of next year. Before leaving, Mr. Younger was presented by the workmen with a stick of colony wood, silver mounted, and bearing a suitable inscription, as a memento of their association with him. During his residence in Georgetown, Mr. Younger became a very useful citizen. In addition to the management of the gas-works, he was Engineer of the East Coast Water Supply, and a Valuator for the Town Council. Both Mr. and Mrs. Younger left the colony with the best wishes of a large number of friends.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 185.)

THE process of quieting down for the autumn proceeded last week on the Stock Exchange; and business in all departments was much reduced. The general characteristic was perhaps a fair degree of steadiness, though here and there it encountered realizations to secure profits. On the whole, prices have not changed much; but Americans were still sufferers from the apprehension engendered by their politicians. The Money Market is a little brighter, and hopeful of doing business with the Russian loan and this week's settlement. But quite the chief feature of the week has been furnished by our special market, where the demand—of a sort that will almost take no denial—has given Gas stocks such a hoist in price as they have not seen for a very long while. The leaps and bounds by which several issues rose showed what an amount of stored strength was in them when they were let go. Gaslight issues were most conspicuous in the upward move. The "A" stock soon showed its disposition, and advanced steadily by almost daily gains; closing five points higher, with business done at 323. The preference stocks had a startling rise in the middle of the week, followed afterwards by the debenture issue, the particulars of which are shown on the Price List at p. 185. Not much South Metropolitan stock changed hands; and prices are rather difficult to fix—say, anything in reason. Meanwhile, the quotations of all issues are put at nominal 10 per cent. margins. Commercials were quiet and unchanged. Very little business was marked in the Suburban and Provincial Companies; but a touch was sufficient to send prices up freely. Brighton had a big bound; and Crystal Palace and Dublin made more modest advances. A very fair amount was done in the Continental group; and prices were good enough, though they did not improve, except that Imperial Continental 3½ per cent. debenture rose a point. Among the remoter undertakings, Bombay was the only gainer. As for the Water Companies, the drought seemed to extend to the Stock Exchange; for there was no business, no change, and nothing doing.

The daily operations were: Business opened moderately well, and prices were good, especially in Gaslight issues; but the only change was a rise of ¼ in Bombay. The general advance began to show itself on Tuesday. Gaslight "A" was active, and rose 1; and ditto "B," 2. On Wednesday, transactions were more limited; but the upward move in price proceeded merrily. In Gaslights, "A" improved 1; "J," 2; and "C," "D," and "E," 3. Crystal Palace also rose 2. On Thursday, the boom in Gaslights was at its height. The "A" advanced 1; "C," "D," and "E," 7½; "F" and "G," 5 each; "J" 10½; and "K," 3½. South Metropolitan "B" rose 3. Prices on Friday were very good all round; and quotations again advanced freely. Gaslight "A" rose 2; ditto, 4½ per cent. debenture, 4½; South Metropolitan "B," 2½; ditto "C," 4½; Brighton and Hove, 10; and both Alliance and Dublins, ½. Saturday was quiet; and the only change was a rise of 1 in Imperial Continental 3½ per cent. debenture.

ELECTRIC LIGHTING MEMORANDA.

Electric Lighting by Artesian Well Power—The Plague of Cheap Incandescent Lamps—How Incandescent Lamp Users are Deceived.

A REMARKABLE kind of electric lighting plant has been established in a new town of Colorado, the description of which is calculated to raise, in the breast of the British manager of an electric lighting station, aspirations impossible of fulfilment. It appears that the district wanted water, and an artesian well was accordingly sunk, until a supply was struck capable of delivering 4432 gallons per minute at a pressure of 110 lbs. per square inch. When the stream was confined and directed by a 2¼-inch nozzle, it rose to a height of 162 feet. This splendid natural phenomenon suggested a development which was forthwith carried out. Why not use the power for electric lighting? No sooner said than done. This is the land of the Pelton wheel; and it was easy to make the water play in a 3-inch jet upon the buckets of a motor of this description. The wheel is coupled direct with the dynamo, of a capacity for 500 lights; and as there is no need of husbanding the power, much of which runs to waste, the service is reported to be everything that could be desired. Raising or lowering the nozzle, so as to spill more or less of the water, regulates the power of the wheel. How beautifully simple! It must be a pleasure to work an electric lighting plant under such ideal conditions; and yet, it is probably safe to say, the people concerned are not happy. The Electric Light Company are not quite satisfied, because there are not enough residents in the "city" to take all the electricity their marvellous well is capable of generating. But it will probably be worse when the demand exceeds the supply for just a fraction of the twenty-four hours. Water power is very seductive so long as there is enough of it and to spare; but it is incapable f being "forced" like a boiler.

According to rumours that take shape and publicity in the electrical press from time to time, the electricity supply interest is much troubled by the plague of "cheap and nasty" incandescent lamps. As an American contemporary has it, "unscrupulous competition has led to a deterioration of quality which has already injured the electric lighting business, and which if it be allowed to go on, will result in a serious set-back. The electric light has now to compete with the Welsbach burner; and there is also the possibility that it may find a strong rival in acetylene. If those engaged in the business compete recklessly with each other in addition, regardless of quality of the light supplied, a period of great tribulation for this industry is certain." Those who are engaged in the incandescent lamp manufacture are, as a matter of fact, exemplifying the law of struggle for existence in a fashion which, however instructive to on-lookers, is most painful for themselves; and the dealers in, and users of, such lamps scarcely know what to do in the circumstances. The original makers under the Edison and Swan patents reduced their prices upon the expiry of the patents; but the moment the field was thrown open, there rushed in a horde of manufacturers bent upon beating the old makers out of it by sheer underselling, without much regard to prime cost, and less to quality. Wise users of lamps, of course, stuck to the old and trusted makers, whose business was not so much affected by the inroads of their rivals as the latter intended. Yet it was inevitable that the flooding of the market by cheap lamps should result in a large number of these manufactures being used, either ignorantly or with deliberation, by consumers of electricity for lighting. The result wherever this process has gone on has been disastrous. So far from the events of the last couple of years having improved the incandescent electric light, they have actually tended to its deterioration. Many users of the light have been unable to resist the temptation to try cheap lamps; and others have experienced difficulty in procuring anything better. This latter is notoriously the case in Germany, where there is not a good lamp to be had for money. In the United States, it is asserted that matters are nearly as bad. Consumers are deluded into buying cheap lamps; and in the general absence of testing facilities, so long as these give a passable light, the user is satisfied, until the bill for current comes in. Mr. Metcalfe, a writer on this subject, demonstrates how reduction in price of lamps, with deterioration of value, works to the disadvantage of both suppliers and consumers of electricity, "on the principle that if a purchaser gets for 50 per cent. of its former price an article worth only 30 per cent. of its former value, he loses 40 per cent. in the transaction." This reads like an arithmetic puzzle, and may be commended to the attention of mathematically-inclined readers.

The greatest uncertainty prevails as to the illuminating power that will be given by lamps of the modern makes. "A lot of fifty lamps, labelled 16 c.p., but represented to have an efficiency of 3·5 watts, were recently tested by the writer, out of which only six lamps were found correctly rated. They showed a very uniform consumption of 56 watts; but a photometer test shows that forty of them measured 14 c.p. or less—making their efficiency 4 watts and under." This disappointing result is ascribed to the demand of lamp users for high efficiency combined with long life—"conditions that cannot be attained to any considerable extent outside of advertising literature." The most economical way to use incandescent electric lamps is to work them hard, and change them the moment they show any falling off in illuminating effect. Yet the cheap manufacturer cheats the consumer by practising economies that mean pence to him, but cost the purchaser many shillings in the long run. The standardizing of the filaments, and the proper exhaustion of the bulbs, are matters that cost both time and money to effect properly. By stopping either process prematurely, a considerable reduction can be made in the prime cost of the lamps; but the efficiency and durability of the lamps suffer when this is done. The best course for users to adopt is to pay a fair price for a good article. But this is the very citadel of sound business that cheap manufacturers' methods are ceaselessly undermining.

THE PROBLEM OF CHEAP FUEL GAS SUPPLY.

A LECTURE was recently delivered before the Franklin Institute by Mr. Nelson W. Perry, an American Mechanical Engineer, on the subject of the utilization of refuse anthracite or culm, which exists in mountainous waste heaps in certain localities. Not the least interesting feature of this discourse was the confessed indebtedness of the lecturer to the late Mr. Denny Lane for his historical demonstration of the economy of energy transmission in the form of combustible gas. Mr. Perry, indeed, corroborates Mr. Denny Lane, and carries the argument further in order to show that only in this way is it economically possible to utilize colliery waste. The lecturer proceeds by successive steps, which it is worth while to follow. He begins his argument by stating that the most powerful aid to the progress of material civilization is the cheapening of our methods of producing power; and, perhaps, second only to this is the improvement of methods of transmitting this power from the point where it can be produced to the best advantage, to the point where it can be most advantageously used.

The case for power transmission is further strengthened by the consideration that while in some industries the cost of

power forms so large a factor in the cost of the manufactured article as to control it, in regarding manufacturing industry as a whole it appears that this cost amounts on the average to about 10 per cent. of the total; so that in the majority of cases it is cheaper to bring the power to the raw material and the factory than to reverse the order of location. The tentative and partial utilization of the power of the Niagara Falls has deservedly attracted much attention from mechanicians and power users, especially as the promise of cheap power is held out as an inducement to manufacturers to settle their industries in the vicinity. Mr. Perry, however, evidently does not think very highly of this inducement; and he proceeds to remark that the collieries of the State of Pennsylvania throw away in their spoil heaps yearly as much potential energy as the estimated maximum yield of the Niagara power works.

Some of this refuse fuel is already being used locally. Thus it is stated that two lighting companies in the neighbourhood of Scranton, Pennsylvania, work upon this fuel, which can be had for the cartage. The latter consideration raises in elementary form the whole question of the economical transmission of energy. Lord Kelvin enunciated, as the law for determining the economical conditions of electricity distribution, that "the interest on the investment in copper should just equal the cost of the energy lost in transmission." This rule is known among electricians as "Thomson's law;" but Mr. Perry remarks that it has a very much wider application than that of electric conductors. It is merely a specialization of the general rule that one must not spend more for economy's sake than the possible saving amounts to, which is an economic law applicable to all industrial affairs.

This is really the consideration that makes the waste heaps round collieries. The farther the coal has to be sent, the better it must be to bear the cost of carriage. Anybody who can use the inferior kinds of coal on the spot is welcome to do so; but the very act of picking it up makes it cost something. The question then arises as to whether colliery waste can be rendered marketable by any sort of preparation that its quality will bear. This at once suggests gasifying it; and this is the application fastened upon by Mr. Perry. He mentions the possible conversion of the material into what is called producer gas, only to dismiss the process as economically impracticable. Water gas is next described, and its value for certain applications admitted; but it is condemned as too costly, even when unpurified and uncarburetted, for fuel purposes. The only remaining form of fuel gas into which the material could be converted is semi-water gas, as made by the processes of Dowson, Lencauchez, and others, which has a fuel value of about one-fourth that of ordinary coal gas. This is Mr. Perry's estimate; and it is rather in excess of the true figure, unless the semi-water gas is supposed to be made of good anthracite. To rate it, bulk for bulk, at one-fifth the fuel value of coal gas would be nearer the average mark.

Mr. Perry proceeds to refer to Mr. Denny Lane's figures relating to the comparative cost and efficiency of transmitting energy in the respective forms of coal gas and electricity; and he agrees that, within certain limits, the former is to be preferred. Moreover, when fuel is delivered in the form of a gas, it is adaptable to all the uses to which fuel is ever applied, and there are no stand-by losses. The latter consideration is so serious, that it seems to outweigh most others in Mr. Perry's mind; and he declares that: "For power purposes a somewhat extensive investigation of the question has satisfied me that, if we can procure cheap gaseous fuel, the gas-engine is the proper thing to use, especially in situations such as are found in our electric lighting stations and elsewhere, where the load is variable between wide limits."

To prefer the gas-engine upon its merits, as a motor capable of yielding a higher duty than the steam-engine for the fuel consumed, does not, however, imply that it is economically defensible to feed such engines with gas piped from a distance, great or small. Mr. Perry does not attempt to deal with this point, and consequently his lecture fails just where it seemed to be leading up to a definite conclusion in this regard. He ventures to assert only that it would be more economical for the electric light and power companies of Philadelphia to convert their coal into gas on the water front, and distribute it thence in pipes to gas-engines favourably located as to distribution, than to cart coal to the central stations and use it for the generation of steam power on the spot. One would have liked to see even this moderate claim supported by evidence. It is an untried suggestion at best; and it will remain so until cause for making a trial is shown.

There have been many such suggestions for supplanting the power-user's and fuel-consumer's bags of coal by fuel gas delivered at a notably lower price than the town's coal gas; but not one of them has been shown to be commercially feasible. The first thing to be considered in this connection is the plain fact that, for an average price of a pound sterling, a ton of good coal can be had in most of the busy centres of population in Great Britain, Europe, and North America. This is a highly concentrated store of energy; and, though coal gas competes with it in many places under very favourable conditions, a vast number of factors have to be reckoned with on both hands before the balance of economical advantage can be proved to be on the side of the gaseous fuel manufactured locally.

Up to a point, it is easier and cheaper to carry coal than to pipe or conduct an equivalent amount of energy in any other form; but the point where the coal merchant leaves it, and the engineer who converts it into something else takes it in hand, is determined by manifold considerations, among which economy and convenience figure largely, but do not wholly prevail. The advantage of the community is a larger term than usually enters into the conception of specialists; yet it determines many questions—among others, the situation of gas-works, coal-yards, and power-factories.

If coal is the most concentrated and portable form of energy, coal gas is the next. If it is true that it pays to send the best coal farther than the worst, the same truth applies to fuel gas. The poorest kind of fuel gas cannot be sent any distance at all, nor stored; so that it must be used as and where it is made. The next grade of gas is very little better. Semi-water gas has only one-fifth the fuel value of ordinary coal gas, while its specific gravity is more than twice as great—being approximately the same as air. Now the delivering capacity of mains for air is, in round figures, about one-fourth less than it is for ordinary coal gas. Taking these considerations into account, we should find it necessary to increase fivefold the capacity of semi-water gas mains, to deliver the same equivalent of heating power as there is in a coal-gas supply, and then to enlarge this figure by one-fourth to allow for the greater sluggishness of the gaseous fluid. This is one of the obvious disadvantages of undertaking to pipe poor fuel gas.

There remains only one way by which these conditions might be altered—the removal altogether or in great part of the bulky, incombustible nitrogen which lets down the fuel value of producer and semi-water gas until they are neither of them worth carrying away from their point of origin. Unfortunately, when nitrogen once gets into a fuel gas, it is apt to stay there, for lack of inducement to come out. In more formal language, nitrogen is very inert, and there is no known ready absorbent of it. Mr. Perry sees plainly enough that if the nitrogen of fuel gas could be taken out of it in some commercial form, it would be a case of "killing two birds with one stone"—the gas would be enriched by the removal of a diluent, while the bye-product would go a long way towards paying for it. Here is where the Fogarty process is expected to come in. This is a suggestion for making cyanide in a cupola by virtue of the theory that nitrogen, when it is heated to a temperature of about 2000° Fahr. in presence of carbon in process of liberation and an alkali, will unite with the latter to form a cyanide. Probably this theory is true, so far as it goes. But as the Frenchman observed, in this matter "there are degrees." It is claimed, we are told, that "if but 3 per cent. of the nitrogen can thus be fixed, the resulting products will be more valuable than the gas, pay the entire expense of its manufacture, and yield a nice profit in addition." The success of the process on a commercial scale has not yet been demonstrated; but a plant of considerable size is being completed with this intent. If all goes well, and the market for cyanide keeps robust, the chemical industries of the world may be added to by Mr. Fogarty's genius. But will the cost of distributing fuel gas be greatly lowered by the same agency? Supposing it to be possible to reduce the capacity of the mains by the 3 per cent. represented by the abstraction of enough nitrogen to yield a paying quantity of cyanide, these mains would still be sufficiently bulky to run into money after a few miles or so. No; not until practically all the nitrogen of producer or semi-water gas can be removed from it by Mr. Fogarty or somebody else, will this kind of fuel become a distributable commodity; and when this happens, a good many other matters will require rearrangement.

Gas-Works Improvements in Philadelphia.—A loan of $7,000,000 has been applied for in order to improve the public works of Philadelphia; and $1,500,000 of it is for the gas-works. New retort charging and drawing machinery is to be introduced; and the mains are to be enlarged. At present only 16,100 of the 263,500 houses in the city have gas-meters in them; and thus two-thirds of the population have to bear the whole expense of public lighting—$700,000—and pay a profit into the city treasury besides. By extending the distribution system to furnish a more general access to the mains and improving the machinery, it is estimated that gas can be furnished to citizens at a cost not exceeding 75 c. per 1000 feet.

The Action of Gas on India-Rubber Tubing.—M. Grosheintz has lately given in the "Bulletin de la Société Industrielle de Mulhouse" particulars of some experiments he carried out to ascertain the effect of the passage of ordinary lighting gas through india-rubber tubes. As far back as 1872, M. Zulkowsky studied the subject from a different standpoint; his investigations being directed to finding out how far india-rubber tubes affected the gas going through them. Both arrived at the same conclusions—viz., that when gas traverses, or is in contact with, such tubing, absorption of the gas goes on. In choosing these tubes, the kind should be selected which contains the greatest number of fixed matters, or that which may be longest used before being discarded on account of the intolerable odour it will throw into the apartment. Black india-rubber, which is the dearest, and is the most objectionable, is, of course, the least used. M. Grosheintz recommends the employment of grey tubing of small diameter and bore—say, 0·32 inch and 0·16 inch—which will absorb less gas, and give off less odour.

NOTES.

Welsbach Burners for Lighthouses.

Reference has already been made in the "JOURNAL" to the articles on "Coast and Lighthouse Illumination in France," contributed to "Engineering" by Dr. C. S. Du Riche Prellier, Assoc.M.Inst.C.E., and to his remarks in regard to the use of Welsbach burners as the luminant for lighthouses. In the course thereof, he gave the results of some general and photometric experiments made with these burners at the Central Dépôt in Paris. They may be summed up as follows: The luminous power of a Welsbach burner fed by rich gas compressed at about 5 feet of water, is 300 candles; that of a 10-wick Trinity House burner is 1800 candles. In a first order eight-panel apparatus, with lower and upper catadioptric lenses, the Welsbach burner gives a light of 185,000 candles; while the Trinity House burner yields only 115,000 candles. The reason of this difference is to be sought in the much higher intrinsic luminous intensity of the Welsbach light, as well as in the greater diffusion of light in a given apparatus. A four-panel second order apparatus lighted with one Welsbach burner fed by compressed oil gas at a pressure of 5 feet of water gives flashes of 300,000-candle power; while an ordinary oil-light of first and second order only gives flashes of 80,000 and 50,000 candles respectively. By increasing the pressure of the gas, the intensity of beam could easily be increased; but for ordinary purposes the pressure adopted is adequate. By using double optical apparatus, in the same lantern, incandescent gas lightning-flash lights of 600,000 candles can be obtained; the flashes being one-tenth of a second in duration at intervals of five seconds. The special advantages of incandescent gas applied to lightning-flash lights consist in the economy and superior facility of attendance as compared with hyper-radiant apparatus, or biform, triform, and quadriform combinations. The author produced some figures showing the comparative cost and the luminous power of a second order incandescent gas-light and a hyper-radiant oil-light. The total cost of the former is £1920, and the luminous power 300,000 candles; that of the latter £4480, and the luminous power 220,000 candles. The power obtained with a single optical apparatus and the incandescent gas-light is about the same as that of the Tory Island triform hyper-radiant light of 326,000 candles.

Wind Pressures on the Mersey.

In a report recently issued respecting the work done last year at the Observatory of the Mersey Docks and Harbour Board, it is stated that the average duration of storms at Liverpool, as defined by the condition that in a storm the wind velocity exceeds 50 miles an hour, is not more than about six hours. The average number of stormy hours in a year is about sixty. There is a clear connection between the temperature and the occurrence of storms. In a diagram showing the number of stormy hours in a month, together with an inverted temperature curve, the two lines markedly coincide with each other. Other diagrams show the connection between barometric weight and wind velocity; the variation of the barometer being taken from the time when no indications of a gale were apparent, till the time when the disturbance passed away. There is a distinct difference between these variations and the wind velocity in the cases of winter and summer storms. In the winter, the fall of the barometer coincides with some degree of approximation with the increase in the severity of the storm; but, on an average, the time of lowest barometer precedes that of maximum wind velocity by about four hours. The rise of the barometer after the time of maximum velocity is more marked than its previous fall; and the mercury stands considerably higher at the end than at the beginning. In the summer, the fall of the barometer as the wind gathers force is very slight—amounting, on an average, to only 0·04 inch, while the lowest barometer occurs five hours before the maximum wind velocity. In nearly half the storms registered, the barometer rose steadily throughout the whole of the disturbance. There was no instance of a storm occurring in the summer months with a barometer above 30 inches; while in winter 10 per cent. of the gales were developed at this pressure. These particulars certainly do not tend to improve the credit of the barometer as a "weather-glass."

The Impregnation and Petrifaction of Cellular Fibres.

During the recent incandescent gas-burner litigation, much stress was laid upon the impregnation process of Dr. Auer von Welsbach in the preparation of mantles, as being radically different from the manufacture of incandescent bodies by any coating process. In a communication to the official journal of the Royal Italian Academy, Signor Enrico Clerici discusses at length the action that takes place when vegetable tissues are soaked in solutions of the salts used in the preparation of incandescent burner mantles; the organic material being afterwards burnt off. He observes that if sections of wood are treated in the same manner with solutions of the nitrates of certain metals, and the resultant ashes are examined under the microscope, every detail of the original tissue is preserved, even down, for example, to the scalariform ducts of *Pteris aquilina*. The author compares this process with the petrifaction of fossil woods; and he concludes that in the Welsbach process there is a phenomenon of molecular interposition by which it is possible to cause certain insoluble and refractory oxides to penetrate into cell-walls and vegetable fibres, so transforming them into true petrifactions, durable and unalterable, in the course of a few minutes. This is a remarkable case of an industrial process being borrowed for a purely scientific application.

The Power of a Horse.

Mr. A. L. Steavenson writes to the "Electrical Review" on the subject of the tractive pull exerted by draught horses. In connection with the substitution of mechanical for animal power for traction purposes, comment has often been excited by the disproportion between the large amount of mechanical energy found to be necessary for this purpose, and the power of the horses superseded by it. This has been explained as due to the necessity of ensuring that the mechanically actuated vehicle shall start under all possible conditions, and to the fact that a horse is capable for a short time, as in the act of starting with his load, of exerting very much more than the normal horse power of effort. The question having been asked by our contemporary, whether anybody knew, from actual dynamometer tests, what is the tractive pull exerted by a horse at different speeds, Mr. Steavenson states that some years ago he had occasion to measure the pull of some of the finest draught horses in the Cleveland mines, which he regards as giving the best results to be obtained from horses when exerting their full tractive strength over short distances. One diagram showed that the horse had exerted a pull of 648·53 lbs. at the speed of 4·62 feet per second, over a distance of 138·6 feet; doing a work of 5·44 conventional horse power. Tramway horses are not so powerful as these animals; but Mr. Steavenson considers that in starting a tramcar they exert a relatively large amount of strength—probably not less than 3¾-horse power. There is every reason to believe that it is this extra exertion which wears out the animals prematurely; but the fact for the mechanician to face is that they are able to exert this extraordinary effort, and are actually required to do so very frequently. Hence it is necessary to provide a proper mechanical equivalent for the potential energy of the animal; which makes mechanical traction systems appear overpowered or the work to be done.

The Loss of Light by Frosted Globes.

Some fresh determinations of the loss of light due to the employment of clear and frosted glass globes have been made by Mr. Stort, and are published in the "Electrotechnisches Zeitung." The lamps used in the experiments were 10 ampère arc regulators, fitted with carbons 17 mm. diameter for the positive, and 10 mm. for the negative. The naked light showed a maximum intensity of 1161 candles; the mean spherical intensity being 362 candles. With clear glass globes, there was an apparent loss of 6 per cent.; and with frosted globes, of 11 per cent. The mean spherical illuminating power with the frosted globes was 320 candles. The effect of opal globes does not appear to have been measured, although these are in far more general use than frosted globes. Losses of light from this source of from 30 to 40 per cent. are admitted; and a good deal more may be lost through the accumulation of dust and soot upon street lanterns in towns. It is observed that no improvement in luminous efficiency seems to have been made in electric arc lamps during the past fifteen years; the prevailing types being yet far from possessing the luminous value attributed to them in electricians' estimates.

Lighting by Acetylene.—The first installation of acetylene lighting in Germany has just been completed at the railway station at Perron, on the Halle-Hettstedt Railway. The system employed is that known as the Kaestner-Korth-Sohns; and it is reported to have given very satisfactory results.

Institution of Civil Engineers.—A *conversazione* was held by the President (Mr. J. Wolfe Barry, C.B.) and Council of the Institution of Civil Engineers, on Wednesday and Thursday, the 15th and 16th inst., to celebrate the opening of the new building in Great George Street. The applications for invitation cards were so numerous, that it was found impossible to accommodate all the guests on one evening. The President and Council were in attendance on both occasions to receive the visitors.

Utilization of the Material of Worn-Out Incandescent Gas Mantles.—The largely increased use of mantles for incandescent gas lighting, which was so conspicuous a feature of the last report of the Incandescent Gas-Light Company, Limited, suggests a question as to what becomes of all those which have done their duty and are removed. It has been found that, although useless for the production of light, the fabric still contains some of the oxides of the rare earths which can be extracted and used over again. Two German investigators—Dr. J. Mai and Herr Jannasch—have, it seems, found out a process for this purpose, which it may be possible to make commercially valuable. It consists in reducing the residues of the mantles with ten times their weight of bisulphide of sodium—taking up the product in water, and adding oxalate of ammonia in excess to re-dissolve the oxalates of thorium and zirconium, while the oxalates of cerium, lanthanum, erbium, and yttrium remain insoluble. The liquor is then filtered; the undissolved oxalates remaining in the filter. The residue is subsequently treated with concentrated hydrochloric acid, in order to obtain the oxalates of thorium and zirconium.

TECHNICAL RECORD.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Review of the Proceedings at the Annual Meeting.

This now venerable body held their annual meeting—the thirty-fifth—in Edinburgh on Wednesday of last week. The hour for assembling was the early one of half-past ten; but the capital of Scotland is now so centrally situated in regard to railway travelling that by the time named there was a muster of members which was generally stated to be larger than at any of the meetings of the Association during at least the past ten years. The gathering, either then or shortly afterwards, included such prominent men in gas circles in Scotland as Mr. R. Mitchell, of Edinburgh, Mr. J. M'Crae, of Dundee, Mr. J. M'Gilchrist, of Dumbarton, Mr. A. MacPherson, of Kirkcaldy, Mr. W. Smith, of Ayr, Mr. J. Thomson, of Inverness, Mr. T. Wilson, of Coatbridge, Mr. A. Wilson, of Dawsholm, &c. It was customary, for some years, for the President of the Incorporated Gas Institute to be present. On this occasion, however, there was no representative of that body, or of the Incorporated Institution of Gas Engineers; but this was according to custom. Among others connected with the Association who were absent may be noted Mr. S. Stewart, of Greenock, whose Commissioners were that day holding their annual meeting for the consideration of the accounts of the undertaking, and Mr. A. Smith, of Aberdeen. The Edinburgh and Leith Gas Commissioners did not extend any welcome to the Association, or any invitation to visit their works, for the reason, most probably, on the one hand, that they gave a luxurious festival in honour of The Gas Institute last year, and, on the other, that the Edinburgh works are at present not in quite a fit condition for perambulations by sight-seers, on account of the introduction of the carburetted water-gas plant and the insecure state of the tall chimney.

Mr. A. Yuill, of Alloa, the President, took the chair; and, after expressing his pleasure at seeing so large a turn-out of members, he at once called upon the Secretary (Mr. R. S. Carlow, of Arbroath) to read the report of the Committee. This document was more voluminous than usual, and slightly varied from former years in this respect—that it dealt at great length with the proceedings connected with the movement for the provision of standard couplings for gas-meters. The Committee, it appeared, took great pains over the matter, remitted it to a Sub-Committee, who held numerous meetings, discussed the subject from various standpoints, met more than once with the meter makers, made up their minds deliberately as to what they wanted, gave their order specifically, differed with the maker after the specimens were laid before them, sent them back to be altered according to their view, and finally submitted them to the Committee, who adopted them, and sent them on to the Association. So thoroughly had the Committee done their work, that when the subject was brought before the Association, the standards were adopted without remark. Mr. J. Napier Myers, of Saltcoats, upon whose initiation the movement was started, suggested that the Board of Trade might be communicated with, with a view to the standards being made national. But he was easily persuaded to let the matter drop, by the remark that great progress had been made in the matter by the getting of the unanimous consent of the meter makers in Scotland to the standards, and that it might be left to the Committee. The new standards will come into force on the 1st of January next.

The report of the Committee regarding the membership showed that it had increased from 228 to 232; but there were some regrettable partings with members—such as the death during the year of Mr. R. Robertson, of Bathgate, and the resignation of Mr. F. T. C. Linton, of Leith. The report by the Auditor—Mr. R. B. Main, of Glasgow—showed the funds of the Association to be in a flourishing condition; and Mr. Main readily gave the credit for this state of matters to the scheme of rearrangement of the subscriptions which was brought forward by Mr. Carlow two or three years ago.

The President's address is worthy of careful perusal, and more particularly his remarks with reference to enrichment. Mr. Yuill is one of the strongest of the Peebles process men; and it was to be expected that he would say something that would turn attention to it. It could scarcely have been looked for, however, that he should produce the figures he did, proving the superiority of the system, in the matter of cost, over carburetted water-gas processes. This is a point in gas making which ought to be looked into by everyone who may contemplate a change of plant. Another feature of Mr. Yuill's address was the passage in which he, for the present, doomed enrichment by tar. After what has been said, in more than one quarter, as to the results obtained from the use of tar, it comes as a surprise to learn that it is not profitable to employ it. In this connection, too, it was brought out that the popular enricher at present is blast-furnace oil—an oil which is little more than a refuse. Mr. Yuill is always practical; and his remarks with reference to the residuals market should be read with keen interest.

Mr. Henry O'Connor's paper on "Some Labour-Saving Methods in Photometrical Testing" did not, in its title, reveal that the author had in view the production of so valuable an apparatus as his compensating meter, which consequently took the meeting rather by surprise.

The paper by Mr. William Young, of Peebles, on "The Permanency of Illuminating Gas," was a narrative of former communications by him, with, in the end, passages directed to the clearing away of some fallacies regarding vapour enrichment. Mr. Young's unfortunate, but unavoidable, absence robbed it of much of its value; but that may be restored by the arrangement which has been come to, to allow him to reply, in the published proceedings of the meeting, to the remarks which were made upon it.

Office-bearers for the year were then appointed. The post of President fell to Mr. A. Bell, of Dalkeith. Mr. Bell spent a considerable period of his working life as Manager of the gas-works at Gibraltar; and since his return to this country he has settled down in a quiet country town, where, it may be safely said, he is too big for the situation—that is to say, he is fit for a much better one. This wide experience well qualifies him for the post of President.

After the adjournment for luncheon, propositions for the disposal of the Murdoch Memorial Fund were submitted by Mr. J. M'Crae and others. The Committee in charge of the fund have found themselves hampered by lack of subscriptions. Last year, Mr. M'Gilchrist, the Convener, expressed the hope that by this time they would have £500 in hand; but the fund does not seem to have grown much during the year, as it was then upwards of £190, and it is now about £200. It is evident that, for the present, it is hopeless to proceed further in the matter of raising a lasting memorial to William Murdoch, and the Committee have fallen back on the practical policy of providing a gas-engine for the physical laboratory in Glasgow University, where it will be in evidence before the students as having been provided by the Association. This step has been taken on the suggestion of Mr. Andrew Stewart, who has already given £15,000 towards the founding of a Chair in the University.

Then came the principal item of business before the meeting—Mr. Forbes Waddell's paper on "The Forfar Retort-House Plant." The paper had reference to the accident which occurred in the retort-house at Forfar in November last. Mr. Waddell narrowed it down to the question of the amount of seal in the hydraulic main, which, again, led to the consideration of Mr. Waddell's method of drawing the tar and the liquor from the hydraulic main by separate pipes. In the discussion which took place, everyone did not, by any means, agree with Mr. Waddell in having separate overflows; but there was an almost unanimous agreement that the accident was brought about by extraneous means, which really points to foul play. One of Mr. Waddell's Commissioners was at the meeting, and the discussion in his hearing, if it served no other purpose, should help to remove some of the prejudices which have prevailed towards Mr. Waddell in the Forfar Gas Corporation.

Mr. J. M'Gilchrist, of Dumbarton, contributed a gossipy, but interesting, budget of notes on the supply of The Gaslight and Coke Company, of London; and Mr. J. Ballantyne, of Rothesay, who was rather hurried by reason of the lateness of the hour, described certain conclusions he had arrived at upon the subject of back-pressure. It was scarcely possible to follow him in his remarks or his practical illustrations; but his paper, when published, will bear perusal and reflection.

This concluded the technical portion of the meeting, which was closed, soon after five o'clock, with the customary presentation of the President's medal and the passing of votes of thanks. Mr. Yuill is to be congratulated on his management of the meeting. The weather on Thursday was pleasant, and the excursion was very much enjoyed.

Report of Proceedings.

The Thirty-fifth Annual General Meeting of the North British Association of Gas Managers was held in the Waterloo Hotel, Edinburgh, last Wednesday—the PRESIDENT (Mr. A. Yuill, the Manager of the Alloa Corporation Gas-Works) in the chair. There was a larger attendance of members than usual.

REPORT OF THE COMMITTEE.

The SECRETARY (Mr. R. S. Carlow, of Arbroath) read the report of the Committee, which contained the following remarks on the standardizing of meter unions:—

A meeting of the Research Committee of the Association was held in the Waterloo Hotel, Edinburgh, on Wednesday, Nov. 20, 1895, when there were present: Messrs. A. Yuill (President), J. M'Gilchrist, Jas. Carmichael, Hubert Pooley, T. Wilson, A. Wilson, A. Bell, and R. S. Carlow (Secretary). The Committee took into consideration the remit made at the last annual meeting on the paper read by Mr. J. Napier Myers on the subject of "Standardizing Meter Unions." All the meter makers of Edinburgh were, by invitation of the President, asked to be present at the meeting. Messrs. J. Milne and Son, Limited, were represented by Mr. H. O'Connor; Messrs. D. Bruce Peebles and Co. by Mr. D. Bruce Peebles; Messrs. R. Laidlaw and Son, by Mr. Young; Messrs. W. and B. Cowan, Limited, by Mr. Joseph Hepworth; and Messrs. Alder and Mackay, by Messrs. Bennet and Mackenzie. The different points raised in Mr. Myers' paper and the discussion thereon were fully discussed by all the parties present. The unanimous finding of the meeting was that it would be a decided step in the right direction if meter unions could be standardized; and the meter makers present stated that they were quite willing to co-operate with

the Committee in bringing the matter to a successful termination. A Sub-Committee was appointed, with powers, consisting of Messrs. A. Yuill, A. Wilson, A. Bell, J. M'Gilchrist, and R. S. Carlow, to consult together as to selecting from all the different meter unions those best suited for making standards, and to report to a Joint Committee of the General Committee of the Association and the Edinburgh meter makers, to be held at a place and on a day to be arranged.

At a subsequent meeting of the General Committee, held in the North British Station Hotel, Glasgow, on the 15th of April, the report prepared by the Sub-Research Committee was read by the Secretary, and the patterns or ideal meter unions were produced by Mr. W. Motherwell, Engineer, of Glasgow, and were carefully examined. The report of the Sub-Committee was as follows:—

"Your Sub-Committee met in the meter department of the Glasgow Corporation, Wall Street, on Nov. 27, 1895, when, through the kindness of Mr. Foulis, the Gas Engineer, they were allowed the privilege of inspecting all the meter unions of the different meter makers in the United Kingdom. Mr. Scott, the Superintendent of the Meter Department (as arranged with Mr. Wilson, of Dawsholm, one of the members of your Sub-Committee) had all the different sizes of meter unions arranged in proper order for the inspection of the Sub-Committee; and they had no difficulty whatever in selecting from these unions those which they thought should be made the standards for use by the meter makers for their meters. Mr. W. Motherwell, Engineer, of 32, Portman Street, Glasgow, was asked by your Committee to attend the meeting; and the subject of standardizing meter unions in all its bearings—viz., which screws should be adopted, how many threads to the size of screw, thickness of metal in the different parts of the unions, and other details—were fully discussed by the Sub-Committee along with Mr. Motherwell and Mr. Scott. The Sub-Committee again met on Jan. 28, 1896, in the North British Station Hotel, Glasgow, when Mr. Motherwell produced the drawings, which were tabled, and which he was at the last meeting of the Sub-Committee instructed to prepare; and the Sub-Committee minutely examined them and carefully went over the whole details regarding screws, threads, thickness of metal, &c., again, in order that there might be no mistake. After this Mr. Motherwell was instructed to prepare steel gauges of the different sizes of unions, with plugs, caps, &c., and to produce them to a meeting of the Sub-Committee. The Sub-Committee again met on April 1, in the North British Station Hotel, Glasgow, when Mr. Motherwell produced the steel unions, with plugs, caps, &c., which he was instructed at the last meeting to prepare. These were carefully inspected by the Sub-Committee, and every detail again gone over. The Sub-Committee were of opinion that the couplings, as produced, were not exactly what was wanted, as the different bearings and screws would not go finally home; the screws and bearings being too tight. Mr. Motherwell explained that the couplings had been made as couplings, and of necessity they must be made tight if the meter makers were to use them as unions. The Sub-Committee, however, thought it was best that the couplings should not be made as couplings, but rather they should be made as ideal or pattern unions, so that the Committee might be able to lay the couplings upon the table and say: 'That is the standard union which must be made according to the recommendation or resolution of the North British Association of Gas Managers,' and allow meter makers to make for themselves. Mr. Motherwell was therefore instructed to make the bearings and screws easy, so that the whole of the couplings would be in one piece when exhibited to the members of the General Committee of the Association, and to the meter makers at a Joint Committee meeting to be held. The Sub-Committee again met on Wednesday, May 15, 1896, in the North British Station Hotel, Glasgow, when Mr. Motherwell produced the unions, caps, plugs, &c., which he had finished, and which the Sub-Committee thought very satisfactory. The Sub-Committee have therefore much pleasure in handing over to the General Committee these unions, with the hope that satisfaction will be expressed with their laborious efforts. The Sub-Committee would desire to record how highly they appreciate the kindness of Mr. Foulis in allowing them to inspect the unions at the Meter Department of the Glasgow Corporation; and to Mr. Scott, the Superintendent of the department, for having all the unions arranged for the Committee's inspection—thus saving them a large amount of trouble."

Mr. J. Henderson (Newton-on-Ayr) moved the adoption of the Sub-Committee's report. Mr. J. Ballantyne (Rothesay) seconded the motion, which was unanimously agreed to; and the Secretary was instructed to call a meeting of the Research Committee and the meter makers in Edinburgh, on Wednesday, May 13. The Sub-Research Committee were thanked by the members of the General Committee for the trouble and care they had taken in selecting the meter unions, and for preparing such a good report.

As instructed, the Secretary called a meeting of the Research Committee and the meter makers, which was held in the Waterloo Hotel, Edinburgh. The Secretary read over the report of the Sub-Committee to the full meeting; and the couplings were produced and laid on the table. The standard sizes of the couplings were as follows:—

Couplings.

	Lights.
½ inch	2
¾ "	3 and 5
1 "	10 and 15
1¼ "	20
1½ "	30 and 50
1¾ "	60
2 "	80 and 100

Filling Plugs.

	Lights.
⅜ inch	2, 3, and 5
½ "	10 to 30
¾ "	30 and above.

Caps.

¼ inch	2, 3, 5, and 10
½ "	above 10

The meeting fully discussed the report of the Sub-Committee, and also carefully examined the couplings produced. The meter makers expressed themselves thoroughly satisfied with the Committee's report, and with the couplings produced; and it was unanimously agreed that the couplings be adopted on the standard sizes, and the meeting recommend the adoption of both the Committee's report and the standard size coupling to the annual general meeting of the Association, to be held in Edinburgh on July 22, the standard couplings to come into operation on Jan. 1, 1897.

The Committee expressed regret that they had been under the necessity of deleting a number of names from the roll of membership, owing to deaths, resignations, &c. (a list of which was given). Still it was gratifying, they said, that there were always a large number of parties applying for admission as new members; thus showing that the Association was accomplishing the ends for which it was originated. The membership amounted last year to 228. Deducting the resignations, &c., there remained 219. The following were proposed for admission:—

Ordinary Members.—Brodie, J., Gorebridge; Melville, P., Dysart; M'Laren, J., Tranent; M'Nair, R., Linlithgow; Naismith, J., Dunkeld; Napier, J. W., Auchterarder; Richmond, J., Dunbar; Robertson, J., Bathgate; Ruxton, W. M., Berwick-on-Tweed.

Extraordinary Members.—Bowman, A., Buckhaven; Brown, J., Hamilton; Burns, A. L., Leith; Martin, J., Ladybank.

Associates.—Gracie, H. H., Edinburgh; Royal, J., Arbroath.

The membership consists now of 148 ordinary members; 63 extraordinary members; 15 associates; and 6 honorary members—total, 232.

The PRESIDENT having invited remarks relative to the reports,

Mr. J. B. TERRACE (Brechin) said he saw that Mr. Hislop, of Paisley, had resigned his membership. He thought, as Mr. Hislop had done a great deal for the Association, they might place him on the honorary list.

Mr. J. M'GILCHRIST (Dumbarton) pointed out that only the Committee could suggest to the meeting the advisability of raising anyone to the high position of an honorary member of the Association.

Mr. J. N. MYERS (Saltcoats) asked if there had been any attempt to make the standard meter unions national, by corresponding with the Standards Department of the Board of Trade.

The PRESIDENT said the Committee had done nothing, and could do nothing, but report to the general meeting that day. If the meeting recommended the adoption of the couplings, the Committee would naturally try to give information to this effect to the meter makers. To put the matter in form, he would propose that the reports as read be adopted and recorded in the proceedings of the Association.

Mr. TERRACE seconded the motion, and it was agreed to unanimously.

At a later stage of the proceedings,

Mr. MYERS returned to the subject, and said he understood the President to state that the use of the couplings was to come into force at the beginning of next year. He would suggest that the Committee should correspond with the Standards Department of the Board of Trade, and see if the couplings could be made authoritative. It would be a pity if another country—say, England—were to inquire into the matter, and recommend a set of different couplings. It would be well, he thought, to get the Board of Trade's approval of the unions before the Association. He suggested that the Secretary should write to the Standards Department of the Board of Trade.

The PRESIDENT said he had no doubt the suggestion of Mr. Myers would be considered by the Committee; and the members might rest assured that the Committee would do whatever they thought was in the interest of the Association, and not only of the Association, but of gas suppliers and meter makers.

Mr. J. M'GILCHRIST (Dumbarton) said he thought they had made great progress since the reading of Mr. Myers's paper last year. They had got all the meter makers in Scotland to unanimously agree to introduce the new system of unions on the 1st of January, 1897; and he thought that Mr. Myers might leave with the Committee the matter of corresponding with the Board of Trade.

Mr. MYERS assented to this proposal.

THE AUDITOR'S FINANCIAL STATEMENT.

Mr. R. B. MAIN (Glasgow), the Auditor, reported that the General Fund of the Association amounted to £151 8s. 6d.; the Benevolent Fund to £240 4s. 9d.; and the Research Fund to £84 5s. 2d. It was, he said, the most satisfactory report he had had the honour to submit to the members since he had held his position. He thought the result showed the wisdom of the Committee's action in raising the subscription. No doubt the credit of the present satisfactory position of the finances was largely due to their esteemed Secretary—Mr. Carlow—who spared neither time nor energy in advancing the interests of the Association.

The PRESIDENT intimated that the report was adopted, but he thought they could not pass from this part of the business without giving Mr. Main their hearty thanks for the trouble he had taken in auditing the accounts of the Association.

The suggestion having been cordially adopted,

Mr. MAIN, in acknowledging the vote, said he could assure the members that the labour of the Auditor was but light. It might be very different if they had not a Secretary like Mr. Carlow. He (Mr. Main) had a strong feeling that the time had come when some kind of recognition should be made of

Mr. Carlow's great services to the Association; and he hoped something would be done.

THE PRESIDENT'S ADDRESS.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I feel I cannot enter upon the duties of to-day without first thanking you for the great honour you have conferred upon me in electing me to preside over your deliberations. I felt a little diffidence at first in accepting such a position; but from the assurances I have got from those who have passed the presidential chair, I am conscious I may rely upon your co-operation and assistance in making this meeting a success.

The changes that are taking place must be familiar to all those who have attended the meetings of this Association in recent years. At each succeeding meeting, we are making new acquaintances; and as we look around we miss some familiar faces—some who, in the fulness of their years, have retired with honours to enjoy the evening of their days in peace. We are also reminded of those who have passed the "bourne." In the past year, the grim messenger has dealt gently with the members; but I cannot allow the present occasion to pass without putting on record the great loss the Association have sustained by the death of the gentleman who occupied the presidential chair when we last assembled in this city. I refer to the late Bailie Robertson, of Bathgate. He was one whom the Association delighted to honour; and in doing so, they were only following the example set by his fellow citizens, who were better able to recognize his kindliness of heart and individual worth. Neither must I fail to mention the late Mr. Brodie, of Paisley, who occupied the position of an extraordinary member. We have all pleasing memories of the warmth of his friendship and the uprightness of his character. He was a friend to us all, and a friend to all he came in contact with.

One of the first duties devolving on your Committee during the past year was the consideration of the remit made to them regarding the standardizing of meter unions. The necessity for such standards was evident to every member of the Committee, when they entered upon their labours—more especially when all the patterns of the various makers of meters were placed before them. It was then found that each differed from every other, and that no two were interchangeable. It would be out of place for me to deal further with this matter, after the elaborate report given you by our worthy Secretary; but I may express the hope the meter makers, working in conjunction with the purchasers, will bring the movement to a successful issue.

It appears to be the prerogative of each succeeding President to congratulate the members on the great strides that are taking place in the utilization of gas for lighting, heating, cooking, motive power, and industrial work. Let anyone having a love for statistics compare the present with the past, and I am sure he will be able to say that the gas industry has developed, and will continue to develop; and that it has contributed to the domestic comfort and the industrial economy of all who have been wise enough to call it to their aid. Although I am speaking more directly to members of the gas profession, I must not forget those whom we serve. It has often been remarked that, were the public conscious of the great benefits and conveniences that are at their command, in the proper utilization of gas for the varied purposes to which it is applicable, they would be enjoying pecuniary advantages and domestic comfort they are at present not aware of. By local exhibitions and otherwise, much information has been given to the general public regarding the usefulness of gas for cooking and heating; and this information has fallen upon good ground.

The same cannot be said about the utilization of gas for motive power. A conservative spirit appears to permeate users of power, although a radical change to the latest and newest types of gas-engines would largely contribute to convenience and economy in working. It would be beneficial to the users of power were they made aware of the fact that motive power equal to that given by, say, a 7-horse power steam-engine can be obtained from a gas-engine, with gas at 2s. 6d. per 1000 cubic feet, at a cost of 3¾d. per hour. This, in a week's work, would amount to 16s. 10d. With a steam-engine of the same power, this sum would be absorbed for coal alone, after which the wages of a fireman or attendant would require to be added. It has often been remarked that one gas cooking-stove sells another. The same may be said of gas-engines; for many users of gas-engines, after having experienced the benefits and convenience of working, express their surprise that they were not conscious of the advantages earlier, and try to expiate their fault by recommending the engines to friends who are not so enlightened as they themselves are.

Nearly two decades have elapsed since the great incentive was given to the gas industry by the electric scare, which spread with lightning rapidity, and threw its darkening shadow on everything connected with the profession. As a sequel, gas stock became depressed. Those who had a high idea of their own prophetic powers were not only convinced that the days of gas lighting were numbered, but put themselves to the trouble of whispering into the ears of those they met what they believed to be the inevitable. In the electrical world "like repels like." The same law appears to hold when the two rivals, as they are sometimes termed, are brought together in a commercial sense. Much has been said and written of late regarding the relative cost of gas and electricity. In the clear and lucid address given last month by the President of the Incorporated Gas Institute, there are statistics which may be looked upon as authoritative and conclusive. They may be summarized in a few words. Taking gas at 2s. 6d. per 1000 cubic feet as representing 1, electricity at 5·4d. per unit represents 2·73, light for light. If this difference is brought out with 19-candle gas, what would it be with 28-candle gas? I leave that to scientists and gas engineers to determine.

One often hears it said that the great brilliancy of the electric light entirely pales the poor flickering gas light. Such may be so when you compare a 2000-candle arc light with a 15-candle street-lamp flame. The votaries of the electric light must have been disagreeably disappointed a few weeks ago to find in Paris this order of things reversed, by the Denayrouze Company setting up an exhibition and demonstration in the Boulevard Montmartre, where a cluster of incandescent gas lights were shown, having a power of 8000 candles, which threw into shadow the nearest electric arc light, and at a cost greatly in favour of gas. After one has seen these two pictures, the fact must dawn upon the mind that, after all, it is only a question of quantity; or, in other words, the same amount of light can be obtained from gas as from the electric light, and at a cost which will appeal to the student of economy.

Although we as gas engineers have nothing to fear, we must not look slightingly on our friendly rival, which is often termed the "light of the future." In using this designation, some regard it more in the present tense, while others would fain consider it in the future tense. But, looking upon the electric light in any way, it must be admitted that it has proved its usefulness. As we live in a commercial age, it comes to be a question of relative values. If a merchant or manufacturer finds he requires to pay more for a given quantity of light from electricity than from gas he will seriously consider the question, and be apt to look at it from an economical point of view. When one comes to domestic requirements, and where the commercial element does not enter, the extra expense involved is looked upon, and willingly paid, as a luxury.

Blessings often come disguised; and subsequent experience has proved the electric light to be no exception. In the running of a race, we have the goal before us. In life's young dream we have our high ideal, which we ever try to reach. In a professional sense, we have only the desire inherent in us to do our duty; and the determination which arises within us when we find an antagonist running abreast of us in the race, gives us strength and vitalizes our powers to redouble our efforts, so that the laurels may not pass to others. This spirit, I am conscious, permeates most of the members of the gas profession at the present time. May it continue; as the incentive thus given will carry us on, and lead us up to higher things.

I have no wish to dig deep into the question of enrichment, as so much has been said and written on the subject that members must now be thoroughly conversant with it—more especially after the able address delivered by Mr. Foulis as President of the Incorporated Institution of Gas Engineers in May last, wherein he proved, most conclusively, both the enriching value and the thorough permanency of oil gas. The results of his experiments proved that under certain conditions—depending on the temperature of the retorts—oil gas was obtained having an enriching value of 117 candles per 5 cubic feet. Those who have had practical experience of working with oil gas expected these results; as they soon begin to learn, without the use of a pyrometer, the heat necessary to give the best results. One of the best tests of the heats is the observation, from time to time, of the colour of the gas as it is being made. In dealing with fresh oil, no difficulty is experienced in obtaining gas of a high enriching value; but when you come to re-distil the residual oils, you find that the enriching value of the gas falls. But taking all the gas made from a certain quantity of oil, no difficulty need be experienced in getting a gas having an average enriching value of 90 candles per 5 cubic feet.

Carburetted water gas has pushed itself to the front, and has commanded a few votaries who are loud in their praise of it. We are nothing if we have not the power of observation within us, and the power of making comparisons. It is possible that, by reason of the glowing accounts that have appeared from time to time, some members may have become imbued with the idea that carburetted water gas—whether used alone or as an enricher—can be produced much cheaper than any other gas. As I had some doubts on this point, I took the trouble of comparing the two systems. In his presidential address last year, Mr. Wilson placed before members the manufacturing charges for 1000 cubic feet of carburetted water gas as then manufactured at the Dawsholm gas-works; the trial extending over such a period as raised it beyond the experimental stage, and placed it more on the basis of practical working. From these figures, I have taken the cost of gas having an illuminating power of 28·53 candles, as this figure nearly corresponds with the average illuminating power of the gas supplied by the Corporation which I represent. The cost of gas made from coal and oil is the actual cost as taken from the balance-sheet for the past year, which removes all imaginative estimates from the comparison. The average illuminating power of the gas supplied during the year, as reported by the official gas examiner, was 28·07 candles; but allowance can be made for the slight difference between that and Mr. Wilson's figure.

COMPARATIVE COST.

Carburetted Water Gas. Illum. power, 28·53 candles.	Pence per 1000.	*Coal and Oil Gas.* Illum. power, 28·07 candles.	Pence per 1000.
Coke	1·240	Coal	8·760
Breeze	0·016	Oil	3·202
Oil	10·057	Royalty	0·174
Labour	1·600	Labour	3·080
Purification	0·570	Purification	0·488
Sundries	0·250	Sundries	0·350
	13·733		16·054
No residuals	—	Less residuals	6·087
Net cost	13·733	Net cost	9·967
Cost per pound of sperm	0·140	Cost per pound of sperm	0·104
Cost per candle per 1000 cubic feet	0·481	Cost per candle per 1000 cubic feet	0·351

From the above, it will be observed that the cost of gas made from coal and oil, less residuals, was 9·967d. per 1000 cubic feet, as against 13·733d. for carburetted water gas; showing a difference of 3·766d. per 1000 cubic feet in favour of gas made from coal and oil in the ordinary manner. Were mechanical stoking introduced instead of manual labour, there would be a saving of 1·280d. per 1000 cubic feet, on the average, which sum, added to the above difference of 3·766d., would bring out a clear saving of 5·046d. per 1000 cubic feet.

At works where gasholder accommodation and retort-house space is limited, an installation of water gas plant may prove convenient; but, in my opinion, the difference in price is too large a sum to pay for this convenience. The above amount of 5·046d. per 1000 cubic feet, on an annual make of, say, 50 million cubic feet, would pay interest and sinking fund on a capital charge of over £19,000, which would go a long way towards providing the extra accommodation required on a works of the size stated.

The above calculations for coal and oil gas are based on the present price of shale oil. Since then the spirit of evolution has been abroad, and has whispered into the ears of those using shale oil for enrichment that better financial results can be obtained by using blast-furnace oil. Allowance must be made for the difference in the enriching value of the two classes of oil; but even after this has been done, a difference remains which warrants the use of the furnace oil to the exclusion of shale oil. A comparison of the two classes of oil, based on their sperm value, and also on their respective prices, gives the following:—

Shale oil . . . . . 6,980 lbs. sperm per ton.
Blast-furnace oil . . . . . 4,550 „ „
or 10·24 lbs. sperm per one pennyworth of shale oil, against
25·27 „ „ „ „ blast-furnace oil.

From the above, it will be seen that, for shale oil to compete with blast-furnace oil, the price of the former would require to be considerably less than it is at present. Those who have had experience in the working of both classes of oil, have had practical proof of the benefit to be derived from the working of the oil in question, both from a technical and from a financial point of view.

It may have occurred to some that the hydrocarbons existing in coal tar, if properly utilized, would give all the enrichment required. It is possible such might be the case, could the tar be properly utilized; but from our present information, we are only able to get about 1400 lbs. of sperm from 1 ton of ordinary tar when utilized for gas making. Further research may enable us to raise this value; but if we consider the question as it stands at present, I fail to see the propriety of trying to utilize the tar for such a purpose, when we are able to substitute another substance at a much less cost, besides giving three times the sperm value. From blast-furnace oil, 910 candle-hours are obtained, compared with 280 candle-hours from ordinary coal tar. Suppose their relative prices were taken, then they would stand as under:—

Blast-furnace oil . . . 5·05 candle-hours for one penny.
Coal tar . . . . . 0·93 „ „

The price of the former is taken at the present contract rates; and the price of the latter is what is obtained, placed in tank-waggons. I have no desire to make comparisons with other modes of enrichment, but will content myself by recommending to your attention the figures and information I have given.

In the hurry and bustle which would seem inevitable in this commercial world, the great desire is to have the order-book full—to beat the record as it were. But in our particular line, however anxious we may be to achieve this, we must be careful not to buy it at too high a price. I do not speak of confining or cribbing any legitimate method of increasing our sale of gas. But we ought to make sure, in estimating for the supply of new districts outside the lighting area, that the initial cost of providing for such a supply will be in the same ratio as to other consumers, after due allowance is made for the increased cost necessitated by such a supply.

Among the many factors for increasing the sale of gas, the introduction of the automatic meter occupies no mean place; as by its aid the consumption can be largely increased. It also conveys the consciousness to those who have adopted the system that they are accommodating and benefiting those who before were contributors to other modes of lighting. Some time ago, it was mentioned that one large company had imagined that the introduction of automatic meters had not proved so remunerative as was at first anticipated. A good deal depends on what a company or corporation spends on an individual consumer, and whether the profit from the annual consumption will recoup them for their outlay. The automatic meter is introduced in the South under somewhat different conditions to those that prevail north of the Tweed. In the Metropolis, and over a large part of England, whole blocks of tenements pass from the contractor's hands, ready for occupancy, without a single gas-pipe having been laid. In a great many cases, before a supply of gas can be obtained, the company or corporation has to lay on the service and the whole interior fittings at their own expense, and either charge an annual sum as interest on the outlay or its equivalent in the price of the gas supplied. Our experience in the North differs somewhat from this, as we find landlords more generous in providing gas-fittings to all new buildings, whether the incoming tenant may be a consumer or not. Should a supply of gas be required at any time, the works fitter has only to connect the meter, and a new consumer is registered.

In my experience, I have no reason to regret the introduction of automatic meters, which increased my sale of gas last year over 2 per cent. From a financial point of view, they have realized the anticipations formed. Taking an average of the consumption over the whole year, and allowing for the cost of gas, interest, and sinking fund, the balance remaining shows a profit of over 14 per cent., which should be considered a fair investment.

Besides conferring a pecuniary benefit upon the company or corporation, as the case may be, it also confers a pecuniary advantage upon the consumers—at least, some have benefited themselves in a manner that was not at first anticipated. The gas manager in a town situated under the shadow of the Ochils was surprised by receiving one day a peremptory command from one of his consumers to go along with him to his house as he wanted a pair of boots. The manager failed to comprehend or see the affinity that existed between an automatic meter and a pair of boots; but, with the natural shrewdness and caution which is characteristic of him, he remained silent until an explanation presented itself. As soon as he arrived at the house in question, the man informed him that he had been saving up for some time, and had deposited the money in the meter. He had put in florins instead of pennies, as he could spare them, until he imagined he had as much as would purchase the object of his desire. Pardon me for the digression; but this is no isolated example of the uses to which these meters are put. Many gas managers are able to narrate similar experiences, which clearly show that, besides conferring a benefit by illuminating the poor man's home to better advantage, the meter, so much maligned at times, is fostering those habits of thrift which previously existed only in the embryo state.

During the past year our peace of mind has been somewhat disturbed by the depression which has taken hold of the residuals market. If it will give us any satisfaction, we may dream over the time when sulphate of ammonia was selling at a price double what it is at present, and crude naphtha at three times the current value; but we must forego this pleasure when we are brought face to face with the reality. I would have liked if I could have seen a rift in the dark cloud of depression, so that I might have spied the silver lining; but I am not gifted with the power of prophecy, and am unable to predict what benefits the future will bring.

In considering the oft-debated question of agricultural depression, I feel it will serve no good purpose to remind those most interested as to the apparent error they make in purchasing nitrate of soda at a price in some cases above the present market value of sulphate of ammonia, when the nitrogenous value of the two stands in the ratio of 16·47 per cent. to 21·21 per cent. In considering this question, two indisputable facts remain—that though sulphate of ammonia contains over 28 per cent. more nitrogenous value than nitrate of soda, farmers and other agricultural users pay equal rates for both, and in some cases show their want of knowledge by giving a higher price for the latter. The only ray of hope is the increase that is taking place in the export of sulphate of ammonia, amounting, as it does, to the end of June, to over 28 per cent. This fact may ultimately bring about its own reward, and place sulphate in its proper relative position regarding price, which is a consummation we all wish for.

The recognition of benzol as an enricher, both simple and easy to manipulate, will undoubtedly have a tendency to keep up the price of tar, and otherwise prevent it from falling to the low level recorded some time ago.

In speaking of the low price of residuals, we must not allow our spirits to sink in the same ratio, but rather should we look upon the depression as an incentive to recover the income thus lost by effecting savings in other departments. Nowhere can this be done better than in the retort-house. It is now looked upon as an axiom that it is there that financial difficulties are surmounted. This amounts to a truism, when everything there is as it ought to be. But, however conscious we may be of the completeness of our arrangements, a better way than the customary one can usually be found. Perhaps some of you may remember that in an address I gave in Glasgow in April

last year, I ventured upon an innovation in the heating of our retorts. I then mentioned that the ordinary way of heating was to utilize the motive power of the chimney to draw the primary air through the producers for the production of carbonic oxide, and also to draw in the secondary air for secondary combustion, instead of placing the producer under forced draught of air, along with steam, for the primary combustion, and allowing the motive power of the chimney to draw in the secondary air for the secondary combustion. Since that time, I have had practical proof of the efficiency of the latter system. I do not wish to enlarge on this point at present, further than to state that the system is being adopted at three works, where they will have a practical proof of its efficacy during the coming winter. Possibly those in charge at these works may favour members of the Association with their experience at a future meeting.

To those who have studied the regenerative setting of retorts, the fact becomes evident that the best results are obtained when the combustible gases and the secondary air are brought intimately together. It serves no good purpose to have large gas-outlets alongside large secondary air-ports, but rather the opposite. The nearer we approach the ideal of bringing one molecule of combustible gas in contact with its combining molecule of oxygen, the nearer shall we approach ideal combustion, which will manifest itself in the resulting temperature in the retorts, together with a saving of the fuel account, and also a saving in the deterioration of the retort-settings.

I am sure we shall all profit from the information to be given in the papers which are to be presented to-day by various members; and I am conscious that one of the best tributes you can pay to the authors of these papers is to take an intelligent part in the discussion; so that our knowledge may be still further extended.

Mr. R. Mitchell (Edinburgh) said they had listened with very great pleasure to an admirable address by the President. He had touched upon several subjects, and had given his opinions upon certain points of manufacture, which were well worthy of their study. With reference to water gas, some might be inclined to differ from him. They would have, however, to await the results of their own experience. He might state that at present he was busy with the erection of a water-gas plant of a capacity of 3 million cubic feet per day; so that he hoped that what Mr. Yuill predicted would not result with him. He proposed a hearty vote of thanks to the President for his able address.

The vote was unanimously accorded.

Papers and Discussions.

The following papers were then read: "Some Labour-Saving Methods in Photometrical Testing," by Mr. H. O'Connor, Assoc.M.Inst.C.E., of Edinburgh; "On the Permanency of Illuminating Gas," by Mr. W. Young, of Peebles [read for him, in his absence, by Mr. A. MacPherson, of Kirkcaldy]; "Forfar Retort-House Plant," by Mr. Forbes Waddell, of Forfar; "Notes on London Gas Supply," by Mr. James M'Gilchrist, of Dumbarton; and "On Back-Pressure," by Mr. J. Ballantyne, of Rothesay.

Election of Office-Bearers.

The result of the ballot for the election of office-bearers was as follows:—

President.—A. Bell, Dalkeith.
Vice-Presidents.—Thomas Wilson, Coatbridge; Hubert Pooley, Dunfermline.
Secretary and Treasurer.—R. S. Carlow, Arbroath.
Members of Committee.—A. MacPherson, Kirkcaldy; J. M'Crae, Dundee; W. Ewing, Hamilton; A. Wilson, Dawsholm.
Auditor.—R. B. Main, Glasgow.

Place of Next Meeting.

It was agreed that the meeting of the Association next year should be held at Ayr.

The Murdoch Memorial Fund.

Mr. J. M'Crae (Dundee) said the members were aware that the question of how to dispose of the funds collected for the purpose of providing a memorial to Murdoch, the inventor of gas lighting, had occupied the attention of the Association for a considerable time. It might have occurred to several that the proceedings had been somewhat dragged; but it was fair to say that the amount of money at their disposal was not sufficient to endow a bursary—which was the proposal that was first entertained—worthy of the name; but they landed upon a gentleman whose name would commend itself to everyone, than whom a better could not be found to champion the cause they all desired to see brought to a satisfactory issue. That gentleman was Mr. Andrew Stewart. Mr. Stewart had already given a very large sum to the Glasgow University; and the idea occurred that it might be made the channel through which the money could be disposed of, and not only disposed of, but also applied to some of the technical classes in the University, in a way which would be closely connected with the gas industry. It was thought by some of them that a gas-engine might be placed there, upon which would be a plate with an inscription stating that the engine was from the Association, and was put there to commemorate Murdoch. All the students attending the classes would know that the engine was the gift of the Association, in memory of the man who produced the light with which they were identified—and a light which was growing in interest. It was only recently that they discovered this outlet, which seemed to be a most desirable one. It was useless for them to attempt things they could not accomplish. But they could accomplish this; and it was quite on the lines of their profession.

Mr. A. MacPherson (Kirkcaldy) said he had little to add to Mr. M'Crae's remarks; but he thought the Association could not do better than supply a gas-engine to the physical laboratory which was being erected in the University of Glasgow. They knew that Mr. Andrew Stewart took a lively interest in educational matters, and had contributed about £15,000 to found a chair in the University. They were to be allowed to place the engine there; and to put upon it a plate testifying that it was in memory of Murdoch. Their aim, year after year, had been to found a bursary; but they had not been able to do this. They had in hand about £200, which might be employed in supplying the engine and any other apparatus which the Professor might think of.

Mr. M'Gilchrist said he was thoroughly in sympathy with the previous speakers. As an Association, they were indebted to Mr. Andrew Stewart for the great interest he had taken in the Murdoch Memorial from its inception; and he thought they could not do better than follow his suggestion, and erect in Glasgow University a gas-engine, to be called the Murdoch Memorial Gas-Engine. He might say that the University of Glasgow would maintain the engine, so that there would be no further charge on the Association. He had also to report that they had a considerable number of copies of the book entitled "Light Without a Wick;" and he thought that there was a sufficient sum to enable them to have a number of copies bound, and perhaps one might be presented to each member of the Association. If they approved of this, and left it in the hands of the Committee, he might say it would be their pleasure to carry out the instructions of the Association.

The President thought the proposal brought forward was about the best that could have been made. Seeing that the Committee had done so well in the past, he considered they ought to agree to what had been suggested. Perhaps this year they might have a final report from the Committee. He had pleasure in moving that the Committee—Mr. M'Crae, Mr. MacPherson, and Mr. M'Gilchrist—be re-appointed, to carry out the proposals which had been made.

Mr. A. Bell (Dalkeith) seconded the motion; and it was adopted.

The President's Medal.

Mr. A. Wilson (Dawsholm) then presented the President's Medal to Mr. Yuill, accompanied by the good wishes of the members.

Mr. M'Gilchrist proposed a vote of thanks to Mr. Carlow, and suggested the desirability of their securing his services for a further term of office. They had had him now for ten years. He also threw out the suggestion that the Committee should be empowered to make a small presentation to Mr. Carlow at any time the Committee might select.

The President supported the suggestion; and it was at once agreed to.

A vote of thanks to the President concluded the proceedings.

The members and their friends, including a few ladies, subsequently dined together in the Victoria Hall of the hotel—Mr. Yuill in the chair, with Mr. A. Bell and Mr. Thomas Wilson as croupiers. On Thursday, a large party of members and friends enjoyed an excursion to Stirling by boat from Leith, and (after luncheon) drove to Alloa to meet the boat on its return journey down the Forth.

THE PERMANENCY OF ILLUMINATING GAS.

By William Young, of Peebles.

[A Paper read before the North British Association of Gas Managers last Wednesday.]

On the occasion of our last meeting at Melrose, I had the honour of reading before you a paper suggested by the special attention that had been drawn to the chemical and physical constituents of illuminating gas, in relation to its illuminating value, through the recent introduction of various new processes for the manufacture and enrichment of illuminating gas. These new processes have had a like effect in drawing attention to the relative permanency of the gas so manufactured or enriched, and to the conditions influencing the permanency of illuminating gas generally. As this subject, in one form or another, had been on several previous occasions before this and kindred Associations of the West of Scotland, it occurred to me that those past communications might with advantage be reviewed in the light of the modern position of gas manufacture.

The permanency of an illuminating gas depends upon its vapour tension; and this depends upon the vapour tension of its constituents. By vapour tension I mean, as I need hardly explain to you, the tension or pressure at which a gas or vapour stands when it is in contact with its own condensed liquid at the particular temperature which we may be contemplating. In a more volatile liquid, this is higher; in a less volatile liquid, it is

lower. Speaking generally, the heavy hydrocarbons present a low vapour tension at ordinary temperatures; and they are more readily condensed. Light hydrocarbons, on the other hand, present a much higher vapour tension; and their vapours are less readily condensed. In theory, if the components of a mixture of gases acted in respect to one another as simple diluents, the actual pressure exerted by the gaseous mixture would be the sum of the partial pressures due to each component of the mixture; and if you chill such a mixture, each component will separately begin to condense out, without reference to the others, as soon as the partial pressure exerted by it, considered alone, is equal to its own "vapour tension." This is familiar in the ordinary deposition of dew, when the temperature falls to the dew-point.

In practice, with the gases with which we are concerned, the matter is by no means so simple; for the various components of coal gas do not act as simple diluents of one another. They act more like mutual solvents; and the gas acts more as a whole—as if it had a vapour tension of its own—which I call the combined vapour tension, for the sake of a name. Then, at any given particular temperature, we must apply a certain pressure to the gas in order to induce condensation to begin; and this pressure is the combined vapour tension, which we may measure in so many inches of mercury. Now, if this requisite pressure or combined vapour tension is, at the temperature we may have in view, less than the ordinary atmospheric pressure, it follows that at this temperature the gas will have begun to condense, if we expose it to the ordinary atmospheric pressure, or a little more; and a gas presenting this characteristic will not be permanent at that temperature, for its vapour tension will have proved itself too low. If, on the other hand, the requisite pressure or combined vapour tension, at any particular temperature, be greater than the atmospheric, we run no risk of condensing it if we expose it to that temperature at ordinary atmospheric pressures; and the gaseous mixture is then permanent.

If the combined vapour tension of such a mixed gas was such as to be in excess of the pressure of the atmosphere, at the lowest temperature, and under the conditions to which such gas is subjected during storage and distribution, then, according to a gas manufacturer's view, such gas would be a permanent gas. If, on the other hand, the combined vapour tension was less than the pressure of the atmosphere at the lowest practical temperature under the conditions to which the gas is exposed, then a portion of the mixed gas would pass from the gaseous to the liquid, or even to the solid, form; and such a gas would not be permanent from the gas manufacturer's point of view.

In order to insure permanence, therefore, the combined vapour tension must be high enough. The amount of this combined vapour tension—that is, the amount of pressure requisite to induce condensation to begin—depends upon two things. These are: First, the temperature to which the gas is exposed; and, second, the amount of solvent affinity which the respective gases and hydrocarbon vapours have for one another. Then, more than this, we find that the mutual solvent action has two other effects: First, that so long as the mixed vapour remains uncondensed, things remain in it uncondensed, being diffused, or suspended, or dissolved in our coal gas, which would have condensed, at any rate in part, if they had been pure or mixed with mere inert gases; and, second, that when condensation of any one component does begin to take place, the liquid formed interferes by its direct solvent action with the remainder of the vapour, and causes constituents of that vapour to condense out which would not, but for that direct solvent action, have condensed out of their own accord, under the particular existing circumstances of temperature and pressure.

One of my earliest contributions to this subject was made to the West of Scotland Association so far back as 1874, at their meeting at Musselburgh. On that occasion, I read a paper on "The Absorption of the Illuminating Constituents in Coal Gas by the Heavy Hydrocarbon Oils." In that paper I explained how my late brother-in-law, Mr. Cusiter, in experimenting with different fluids as a filling for wet meters, found that, on filling a meter with heavy paraffin oil, the oil absorbed nearly all the illuminants—that just as water had the power of absorbing the ammonia, so these heavy hydrocarbon oils had the power of absorbing the illuminants diffused through the gas. It was also found that on heating up, in a distilling apparatus, the oil which had been allowed to absorb the illuminants from the gas, the solvent affinity was overcome, and the absorbed illuminants were set free; and that these appeared partly as a gas and partly as liquid products. It was further observed that different coals gave up to the heavy oils varying quantities and qualities of gaseous and volatile products; that these products also varied when different temperatures were employed in the carbonizing process; and that in all cases the volatile and gaseous hydrocarbon illuminants diffused through the gas resembled the more volatile hydrocarbons present in the tars condensed from the gas. It was further remarked that, as was well known, gases from various coals and other gas-making materials were not alike permanent—some being remarkably so, while others were the reverse—and that the differences in permanency were due to differences in the nature of the light-giving constituents; some gases being principally indebted for their illuminating power to hydrocarbon vapours, and others again to the presence of more gaseous hydrocarbons. It was then pointed out that the solvent affinity of the heavy oils might be applied with advantage in order to ascertain the nature of the hydrocarbons diffused in different gases, and thereby to estimate the relative permanency of these; and a method was described of applying the heavy oils to this purpose.

This paper was followed by three others, which sprung directly from the observed results of the experiments made with heavy oil in the wet meters. Two of these papers were read before the West of Scotland Association in 1875 and 1876; and the other before this Association, also in 1876. The two former papers dealt with the observed solvent affinities of the heavy hydrocarbons for the illuminants in coal gas, and the part these affinities played during the process of condensation.

In my first communication, it was shown that the volatile hydrocarbon vapours diffused through illuminating gas were identical with the most volatile portions of the tars separated during condensation. In the latter papers, attention was drawn to the fact that if the tar was distilled, and the more volatile portions of the distillate were brought into contact with the gas from which it was originally condensed, these more volatile portions rapidly volatilized and diffused through the gas. The question then naturally suggested itself, Why were these hydrocarbons not left in the gas during the process of manufacture? In the light of the meter experiment, the cause was evident. On conducting the condensation, by allowing the gases and the heavy hydrocarbons to cool in contact with one another, the lighter hydrocarbons had been absorbed from the gases by the heavy hydrocarbons present in the tars; and it was shown that tars, if denuded of their naphthas, rapidly absorbed the illuminants from the gas, and thus reduced its illuminating power. As many of the members present will remember, these observed facts led to the introduction to the notice of this Association of the Aitken and Young system of condensing crude coal gases.

Before describing this process, and with the view of obtaining a clearer insight into the causes leading to the absorption of the illuminants from the gas by the heavy hydrocarbons present in the tars, and into the best method of conducting the process of condensation so as to prevent that injurious action, experiments were made to elucidate the physical laws coming into operation during the process. It was shown that, while the vapour tension of isolated hydrocarbon fluids, and the volumes of their vapours diffusible through a gas at any given temperature, bore a relation to their boiling-point—the lower the boiling-point the higher the vapour tension, and the larger the volume of their vapours diffusible through a gas—yet, on the other hand, with commingled hydrocarbons having different boiling-points, the boiling-point and combined vapour tension were only about the mean of those of the mixed fluids, and varied with the relative proportions of the different hydrocarbons present in the mixed fluid. It was explained that these results were due to the solvent affinity of each hydrocarbon for the others; the solvent affinity of each hydrocarbon modifying the vapour tensions of the others. It was next shown how, on heating the mixed liquid hydrocarbons, the vapour tensions rose rapidly; and the solvent affinity was modified as the temperature rose, but that the vapour of each hydrocarbon acted as the medium through which the others diffused. It was also shown that the hydrocarbons volatilized, and became simultaneously diffused through a gas in volumes of vapour bearing a relation to their boiling-points and to the relative quantities of each hydrocarbon present in the mixed fluids; and that this fact explained why, as was well known, in order to obtain benzol or other isolated hydrocarbons, it was necessary to submit the tar distillate to an elaborate process of fractional distillation, whereby the vapours were subjected to repeated fractional cooling and washing by the condensed part of the distillate—such as was effected in the Coffey still.

The effect of sudden changes of temperature upon gases holding vapours in diffusion, was next referred to. Gases holding vapours in diffusion, when suddenly reduced in temperature had those vapours condensed to the liquid state, but the condensate was in such a fine state of division, that it kept floating forward in a condition of fog or mist in the current of gas, and might travel long distances in that state. It was further shown that coal gases coming from the retorts, on being suddenly cooled, had the denser hydrocarbons condensed and disseminated through the gas in that finely-divided condition; and that these hydrocarbons on being carried forward into the condensers and cooled in contact with these, were thereby enabled to absorb the illuminants. It was also shown that one of the best means of removing these finely-divided suspended hydrocarbons was to bring them into intimate contact with large surfaces, wetted with hydrocarbon fluids.

A diagrammatic table was then referred to, giving the names, the rational formulæ, and the boiling-points of the crude products of the carbonizing of coal at ordinary gas producing temperatures; and attention was drawn to the manner in which it was desirable that these products should be separated or grouped, so as to leave in the gas the products only which would lead to the greatest luminosity, and in the tars only such products as, from lack of volatility or other causes, it would be objectionable to have present in the gas. It was then explained how this grouping of the crude products could be accomplished by the Aitken and Young process of condensation, which em-

bodied the application of these physical laws, during the process of cooling the products coming from the retorts.

It is unnecessary for me to go into the details of the process, as most of those present are fully conversant with its operation. Suffice it for me to state that it consisted essentially in a fractional method of condensing and washing. The condensed products were made to fall back against the current of products coming from the retorts; the ascending vapours and gaseous products being subjected to alternate coolings and washings by the descending current of condensed hydrocarbon products. These condensed products were kept at such a temperature as to prevent the action of the solvent affinity of the dense hydrocarbons upon the more volatile ones; and the more volatile hydrocarbons were thus left in the gas. There is no doubt that the treatment of the crude gas by the process had the effect of leaving in the gas a much larger volume of the vapours of the more volatile hydrocarbons ordinarily left in the tar, and of leaving in the tars hydrocarbons previously left in the gas—in short, that a better fractionation of the products was effected, and that the resulting gas had a considerably higher illuminating power. But it was found in the town in which the process was introduced that the gas was not so permanent. That in consequence of preventing the solvent power of the denser hydrocarbons present in the tars, the gases were left, so to speak, supersaturated with the more volatile hydrocarbons; and that, although the combined vapour tension of the compound gas was sufficiently high to render the gas permanent at ordinary temperatures, yet, when the gas came into contact with the oil present in the leather of the dry meter, the oil asserted its solvent power, and absorbed out of the gas a part of the diffused hydrocarbons, which appeared as a liquid, and interfered with the proper working of the meter. It was thus shown that, in order to produce a permanent gas, it was better to modify the process so as to allow the solvent affinity of the denser hydrocarbons to come partly into action, and thereby to insure that the compound gas would be permanent during distribution.

The next paper bearing upon the subject was read to this Association at their meeting in Edinburgh in 1876, under the title of "The Utilization of the Gases Resulting from the Destructive Distillation of Shale in the Manufacture of Paraffin Oil." This paper explained the method of applying the observed solvent affinity of oil for volatile hydrocarbons, and the physical laws affecting the diffusion of vapours through gas, by a process the exact reverse of the one described during the condensation of illuminating gas. Whereas the former process had for its object to leave in diffusion throughout the illuminating gas as large a volume of hydrocarbon vapours as possible, the latter system was to take from the gases produced in shale-oil distillation as much as possible of these volatile hydrocarbon vapours that could not be removed by simple condensation, but had been left diffused through the gas, and to obtain these vapours in the liquid form. It was explained that the process consisted in bringing dense hydrocarbon oils into intimate and fractional contact with the shale gases, under conditions the reverse of those in the process for the treatment of crude illuminating gases during condensation; and that whereas in the former process the denser hydrocarbons were kept heated, while in contact with the gas, and the denser hydrocarbons were drawn off at the hot end of the condensing arrangement denuded of the volatile vapours, thus leaving the vapours in the gases, in the latter process the denser hydrocarbon oil was refrigerated or cooled to a low temperature, and its solvent power was thereby increased. The cooled oils were brought into contact with the gases, either under atmospheric pressure or compression; and the cooled oil entering the arrangement met the gases nearly denuded of the diffused hydrocarbon vapours, while the oils drawn off at the lower end of the apparatus were loaded with the hydrocarbon vapours which they had absorbed in their passage. Then the volatile hydrocarbon vapours absorbed from the gases by the dense oils were recovered, as volatile fluids, by distillation; and the denuded dense oils were thereafter cooled and returned to the apparatus, and again applied to absorb a fresh load of vapours.

By the application of the process to the shale gas, 80 per cent. of the illuminating power was absorbed by the dense hydrocarbon oils. The absorbed vapours consisted of a large number of distinct hydrocarbons, some of them so volatile as to be permanently gaseous at ordinary temperatures under atmospheric pressure. Indeed, some of them resisted a temperature so low that they were not condensed even when subjected to the cold produced by a mixture of ice and salt. Strong flasks were exhibited to the meeting, containing portions of the distillate which had been thus condensed by ice and salt, and which at once assumed the gaseous form on being allowed to escape into the air. It was then shown how even these very volatile hydrocarbons were held in solution by the portions of the absorbed distillate possessed of higher boiling-points. Since the introduction of this process, millions of gallons of such hydrocarbon fluids have been recovered from the shale gases, as also from the coal gases in carbonizing works, and from the coking of coal. Attention was next directed to the suitability of these hydrocarbon liquids recovered from the shale gases for the carburetting of gases, in order to increase their illuminating power; and it was shown that a gallon of such fluid added in the form of diffused vapour to 1000 cubic feet of coal gas, increased its illuminating power from 10 to 12 candles. I need hardly say that the 20 per cent. or so of the original illuminating power left in the shale gases after treatment, was due to the presence of hydrocarbons which were absolutely permanent at extremely low temperatures.

The facts disclosed in these papers showed that the permanency of illuminating gas is largely dependent upon the treatment it receives during the process of condensation, and demonstrates the important part taken in that treatment by the accompanying tars. So important is this, that it is absolutely necessary, in carbonizing a hydrocarbonaceous substance for the production of illuminating gas, to restrict the decomposing or cracking-up so as to leave sufficient tars to perform the function of washing out of the gas the sooty matter, and leaving the compound gas, through their solvent affinity, with a combined vapour-tension sufficiently high to render it permanent during distribution and storage. On the other hand, the temperature might be so low during the process of carbonizing a carbonaceous substance that products would be formed in which the condensable tars were in excess, and also contained a greater proportion of volatile hydrocarbons than could be taken up in diffusion by the gaseous products. In this case, the effects of the solvent affinity of the denser hydrocarbons would be nullified. Under such conditions, the gas would leave the condensing arrangement saturated or loaded with all the vapours it could hold in diffusion at the temperature of condensation; and therefore the least reduction of temperature beyond this, or contact with absorbent substances, would lead to their partial condensation, and to a consequent loss of illuminating power. These facts further show the difficulties arising from suddenly cooling the products of carbonization. If this be done, instead of a permanent gas, consisting of gases holding vapours of hydrocarbons in diffusion, there is produced a gas holding liquid hydrocarbons in mechanical suspension, and in an extremely fine state of division. These finely-divided hydrocarbons will then travel long distances; and, instead of a true gas, there is produced a mist or fog which, although able to travel long distances, is yet liable to be filtered or rubbed out by mechanical contact with surfaces.

The smaller the quantity of tar present in the gas subjected to sudden lowering of temperature, the greater become the difficulties; for while when the tars are abundant the particles are more liable to coalesce, and besides, by taking up vapours in solution and thus becoming heavy, are more readily precipitated, the reverse is the case when the tars are scanty.

We have an illustration of over-carbonization when, by means of regenerative furnaces, the heats upon the retorts are urged to an extremely high temperature. The lack of tar is here manifested by the stand-pipes choking with sooty carbon, and by pitch accumulating in the hydraulic main; and the gas leaves the condensing arrangement so charged with naphthalene that a portion of this is deposited wherever the gas is subjected to lower temperatures. Under-carbonization is evidenced when shales and rich cannel coals or paraffin oils are cracked up at low temperatures; and the resulting gases are subjected to the ordinary conditions of condensation. Such gases leave the condensers saturated with vapours of volatile hydrocarbons; and these vapours are liable to be condensed by low temperatures and the other causes previously referred to.

As is well known, however, the blending of the gases produced at extremely high temperatures with those produced at low temperatures, renders the combined gases more permanent. In this case, the large proportion of permanent gas present in the products formed at a high temperature, tends to take up and to hold in diffusion the excess vapours present in the low-temperature gas; and these vapours, in their turn, tend to keep the naphthalene in diffusion.

The third condition of matters is well illustrated in the treatment ordinarily applied to the condensation of carburetted water gas. The oil used to carburet the gas is cracked up so as to yield the maximum of carburetting hydrocarbons and a minimum of tars; and the condensation or cooling is effected by a copious contact with cold water. The process occupies only a few seconds of time; and the result of this is that, although the majority of the condensable products have assumed the liquid form, they are in such an extremely fine state of division that only a portion of them can be entangled in the scrubber and carried away by the water. That which is in the finest state of division, is carried forward in the current of gases right into and through the compensation holder into the purifiers, where it is to a large extent filtered out by the purifying material. Mr. Butterfield, late of The Gaslight and Coke Company, states that they have found the hydrocarbons so deposited upon the purifying materials in their carburetted water-gas plant to be a cause of trouble; and it is evident it must be a source of loss.

Although, however, the purifying material filters out and removes most of the suspended hydrocarbon particles from the gas, it does not entirely abstract them, as was shown by an experiment I made on visiting works where a water-gas plant was in operation. On allowing a stream of carburetted water-gas which had passed the purifier to escape into the air, its

presence was made evident by the finely-divided particles present in it dispersing the rays of sunlight passing through it. Such a gas must necessarily be less permanent than if it had been subjected to fractional cooling and washing, in accordance with the principles described in the papers to which I have drawn your attention. It is particularly liable to have its illuminating matter precipitated by rubbing against surfaces during the distribution; and there is no doubt these finely-divided hydrocarbon particles in the gas are the cause of the fouling of the burners, and of the little filiform carbon trees which grow over the burners when carburetted water gas, condensed in the manner described, is used.

We have thus far considered the treatment applied to illuminating gas during the process of condensation, and its effects upon the permanency. I now wish to make a few remarks upon the mode in which the permanency may be modified during the process of cracking up the hydrocarbonaceous substances into gas. Reference has been made to the tables of the crude products formed by carbonizing coal at ordinary gas-producing temperatures, and to the portions of these which it was desirable to have present in the illuminating gas in order to render it permanent. These latter consisted of the hydrocarbons that were either gaseous at ordinary temperatures or which had a very low boiling-point, and consequently a high vapour-tension at the temperatures which the gas might encounter under ordinary circumstances. These desirable hydrocarbon constituents are most abundant in the products of carbonizing at low temperatures. The same temperature, however, which originally produced them will also decompose them into simple and less desirable compounds, if they are long exposed to it. The other hydrocarbons simultaneously produced during the cracking process, although not within the list of those suitable, are yet capable of being cracked up into suitable hydrocarbons.

In the ordinary process of carbonizing, it has been customary to employ a temperature such as will crack up the unsuitable into suitable hydrocarbons while conserving, as far as possible, those first formed. Now it is evident that if, instead of employing that compromise between high and low temperature for carbonizing and cracking-up a hydrocarbonaceous substance for the production of illuminating gas, it was possible to subject the hydrocarbonaceous substance to the action of heat in such a manner that the compounds suitable for forming illuminating gas were removed from the action of heat as they were formed, and were, so to speak, filtered out from the unsuitable compounds, and then, if these compounds were further subjected to heat till they were in turn cracked up into suitable products—in that case it would, by this means, be possible to produce from a given weight of hydrocarbonaceous matter a larger yield of luminous matter of a more permanently gaseous character.

Mr. Bell and I had the honour of bringing such a process under your notice at our last meeting in Dundee in 1893. At that meeting it was shown that an illuminating gas produced at low temperature, supersaturated with hydrocarbon vapours, and therefore not permanent, could be rendered perfectly permanent by the application of the solvent action of the hydrocarbons upon each other. We showed that the liquid hydrocarbons could be, so to speak, used as a filter or sieve to separate from the gas all those products which would prevent the gas being permanent, and would act as the medium of transporting them back to the retort to undergo further cracking, until the whole gas-producing material was ultimately converted into two products—permanent gas of high illuminating power and solid carbon.

By altering the amount and surface of the hydrocarbon applied in the fractional condensing and washing process, the degree of volatility of the hydrocarbons left in the gas can be altered at will, to suit the purpose to which the gas has to be applied. If the gases are to be used to carburet a poor gas through which hydrocarbon vapour of comparatively low tension and small volatility will freely diffuse, the washing with the hydrocarbon fluids is limited so as to allow such to pass away along with the gas. If, on the other hand, these heavy hydrocarbons of low volatility would be objectionable in the gas, the washing with the liquid hydrocarbons is increased, so that only hydrocarbons having a high vapour tension pass away with the gas. Those of low tension are then taken up in solution by the liquid hydrocarbon, and are carried back into the retort, to be further cracked up into those having a higher vapour tension.

In the papers which we have just reviewed, the consideration of the physical laws affecting the vapour-tension of a compound gas has been confined to hydrocarbons which necessarily pass from the vaporous or gaseous into the liquid state; and it was shown that, in consequence of the solvent affinity of such hydrocarbons for each other, the vapour tension of mixed hydrocarbon stood only at a mean between those of the commingled fluids, and that the respective vapours diffused through each other and through a gas in volumes which bear a relation to the respective vapour tensions and to the respective quantities of each hydrocarbon present in the mixed fluids. Such being the case, it is evident that, upon the addition of the vapour of a liquid hydrocarbon to a gas already containing vapours in diffusion, any one of whose vapour tensions was just sufficient to hold it in diffusion and no more, then, unless the vapour tension of the added hydrocarbon vapour was sufficiently (and in most cases extremely) high, the tendency would be for the added vapour to cause the precipitation of a part of the denser vapours already present in the gas. My object in drawing attention to this point is that there is an idea, and a growing idea, that the addition of a vapour of a liquid hydrocarbon to ordinary coal gas has the property of, in some occult way, raising the vapour tension of the hydrocarbons already held in diffusion through the gas, and more particularly that of the vapour of naphthalene.

The latter idea may possibly be true with regard to naphthalene, for naphthalene is one of those hydrocarbons which can pass directly from a state of gas to that of a crystalline solid; and on a former occasion I have shown you, in connection with another subject, that such sublimable crystalline solids lose, to a large extent, their solvent affinity for vapour and gases; that air nearly saturated with the vapour of bisulphide of carbon may be passed through a deep layer of crystalline sulphur—a substance extremely soluble in bisulphide of carbon—without its being deprived of its diffused vapour; and that coal gas, even of fairly high illuminating power, may be passed among pure crystalline naphthalene without having its illuminating power appreciably reduced; while the liquid hydrocarbons from which the naphthalene was filtered, and which had a similar boiling-point, rapidly denuded the gas of its illuminating power when brought into contact with it. It may therefore be possible that the vapours of naphthalene are subject to some modification of the physical laws affecting the diffusion of the vapours of liquid hydrocarbons in coal gases—that just as naphthalene loses its solvent affinity for vapours on assuming the solid crystalline form, so may its condition in the gaseous state be differentiated so that it is held in diffusion in a different manner from other hydrocarbons. I am afraid, however, that the high enriching results that have been obtained and have led to this idea being supported, have been due, not directly to true diffusion of naphthalene vapours through the gas, but to the presence of enriching hydrocarbon vapours. The presence of these vapours would lead, at higher temperatures, to the naphthalene being taken up in a diffused condition, again to be deposited as solid naphthalene on the temperature falling, but in such an extremely fine state of division that it is carried forward with the gas, much in the manner already referred to.

Many years ago, in connection with the manufacture of pneumatic gas, I made a great many experiments with the object of discovering some means of getting that cheap carburetting agent naphthalene to remain in diffusion in air, and to form a part of the carburetting medium in association with other hydrocarbon vapours presenting high vapour tensions, but with negative results only. The naphthalene was invariably precipitated, until only a mere trace of its vapour was left in diffusion; and the precipitated portions, under certain conditions, assumed the extremely fine state of division to which I have referred. The fact that the addition of the vapours of liquid hydrocarbons, in quantities considerably short of saturation, does not prevent naphthalene deposits during distribution of the gases, is further negative evidence as to the effect of these vapours holding the naphthalene in diffusion any further than the additional tension which they communicate to the compound gas would lead us to expect.

In conclusion, I may be allowed to remark, in regard to the commercial aspect of the subject, that in estimating the value of a gas-producing or gas-enriching process, the permanency of the resulting gas should form one of the main factors. It would be unfair to compare a process which produced a perfectly permanent gas—capable of reaching the utmost limit of supply without material alteration, and thus of insuring that all consumers will receive a like value, and of preventing the possibility of the imposition of penalties—with one in which the lack of permanency in the resulting gas made it necessary that the gas should be sent from the works considerably higher in illuminating power than the standard, in order to insure that it may be able to pass the testing-stations without the imposition of a penalty, or in which there may be a loss of a proportion of the added enrichment before the gas reaches the consumer—a proportion which amounts in some cases to as high as 50 per cent.

THE BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

First Annual Meeting.

The First Annual Meeting of the above Association was held last week at Nottingham, under the presidency of Mr. D. M. F. Gaskin, M.Inst.C.E., the Corporation Water Engineer. It was appropriate that the first ordinary meeting should be held at Nottingham, as to that town the Association owes much. It was its birthplace; and to the work of the President, and the facilities and hospitality extended to it in its early days by the Mayor (Alderman Bright), and the Chairman of the Water Committee (Alderman Sands), its success is, in large measure, due. With charming weather last week, an *agenda* full of discussable and instructive topics, and admirable arrangements for interesting visits and drives in the neighbouring country,

the meeting could not fail to be otherwise than enjoyable and profitable. A fitting prelude to the general proceedings took place on Monday evening, when the members, many of whom were accompanied by their wives, were received at the Castle Museum by the Mayor and Mayoress. About eighty guests were present; and for their comfort and entertainment every provision had been made.

The work of the meeting commenced on the following morning in the Exchange Rooms, which were placed at the disposal of the Association by the Mayor.

The PRESIDENT, on taking the chair, extended a hearty welcome to the members. He remarked that the Mayor had officially done this the previous evening; but, as their President, he had great pleasure in welcoming them to the ancient and interesting town of Nottingham.

The SECRETARY (Mr. W. H. Brothers) read the minutes of the meeting held at the Westminster Palace Hotel, on April 11 last; and they were confirmed.

APPOINTMENT OF OFFICIALS.

Messrs. C. Sainty (Windsor) and W. Millhouse (Scarborough) were appointed Scrutineers; and Messrs. W. Terrey (Sheffield) and O. J. Kirby (Batley), Auditors.

The PRESIDENT then read his

INAUGURAL ADDRESS.

In the opening sentences, the President thanked the members for the honour they had done him in electing him the first President of the Association—a position of responsibility which he recognized carried with it duties of no light nature. The inauguration of the Association was then touched upon; and this was followed by an explanation as to the objects for which the members had banded themselves together. He next enumerated a large number of questions upon which water-works authorities required information from time to time; and he particularly referred to the subject of the employment of none but registered plumbers as one to which the Association might well direct its attention. He advocated not only the registration of master plumbers, but of every man executing work either in connection with water-works or sanitary appliances, and also the examination of the executed work by a registered inspector, before allowing a house to be inhabited.

Directing attention to the line of policy and future work of the Association, the President said these could not, he thought, be more concisely given than by quoting from the constitution:

CLAUSE 3.—(*b*) To invite from the members and others communications, written or oral, relating to water-works engineering, management, and finance; and to receive, hear, and discuss such communications at meetings of the Association or elsewhere. (*c*) To invite the exhibition of, and to exhibit at meetings of the Association or elsewhere, any new or improved machinery, apparatus, plans, drawings, or models calculated to advance the knowledge of water-works engineering and management. (*d*) To assist the Legislature, public bodies, and others in ascertaining the views of persons engaged or interested in water-works undertakings. (*e*) To originate and promote improvements in the law, and to support or oppose alterations therein, in all matters relating to water-works. (*f*) To watch over, promote, and protect the mutual interests of its members; and to provide facilities for promoting and maintaining, professionally and socially, a spirit of fraternity among its members. (*g*) To appoint examiners and hold examinations.

It rests with the members themselves, he said, to devote their energies and the time at their disposal to these objects, which, while being beneficial to themselves, will also confer benefit upon others.

Passing from the more immediate objects of the Association to that of the general water supply of towns and districts, the President said he had often been struck with the remark of even thoughtful people—that to supply a town with water, and manage the supply, is work of a much more simple character than that of other branches of engineering. One has, however, only to study carefully the many water works in this country alone, and note the great diversity that exists (of necessity from local and other circumstances) in the treatment and construction of works, to know that they demand a knowledge and experience of hydraulics which can only be obtained by close study, application, and practice to successfully deal with difficulties as they arise. Therefore, while not depreciating the knowledge and experience necessary in other branches of engineering, he claimed for the construction of water-works at least equal importance, and held that the benefit derived by a community provided with a copious and plentiful supply of pure water constantly laid on to each house, constitutes the most important element of health and comfort in every-day life, and cannot be over-estimated. The question of water supply in this country is becoming year by year a more serious one; each scheme brought forward being stubbornly fought by individuals and communities who are thought to be prejudicially affected by it. Having described the object and aim of the water engineer as being the making of the best use of the element which Nature supplies to him to deal with for the use and convenience of man, the President referred to the sources of supply, the principal of which are wells, lakes, and the headwaters of rivers and their tributaries, in all of which consideration of the rainfall of the district over an extended period, the proportion to be allowed for evaporation and compensation, and the geological formation, are of the first importance in determining and designing projected works. This led up to some remarks on ancient wells and modes of supply, and early English work.

Coming down to modern water-works practice, the address proceeded as follows:—

Modern Wells.—Passing on to the construction of modern wells sunk in hard rocks, such as the new red sandstone and chalk, these wells do not often require lining. But one difficulty in hard rock is that blasting is frequently necessary, and operations become tedious and expensive. Partings and beds of clay, sand, and marl are frequently met with; and this often requires a lining to prevent the movable and friable material from falling in. The materials used for lining are principally brick, iron, or wood. In many cases, precautions are necessary to exclude land springs and surface drainage. This may be done by tubing with iron or brick in cement steining backed by clay puddle or concrete.

Tunnels.—In large works of well supply, tunnels are nearly always driven, and are useful as lodges for storing water when the pumps are not at work. Tunnels have also proved in many cases to be sources of considerable addition to the yield of the well by cutting through fissures and faults; the latter acting in many cases as ducts—drawing water often from considerable distances. Of this, there are many examples in the new red sandstone formation of South Lancashire.

Boreholes.—The sinking of boreholes is also a means of considerably augmenting the yield. In the case of a large public well sunk on the Earl of Derby's estate for the St. Helens' Corporation, only a small quantity of water was met with in making the well, which was 170 feet deep; but at the depth of 306 feet below the bottom of the well, the boring reached a bed of sand which yielded a body of water equal to 1¼ million gallons per 24 hours. In the case of another large public well sunk on the Earl of Sefton's estate for the same Corporation, only two miles away from the one last mentioned, the well (150 feet deep) yielded a million gallons of water per 24 hours; while the borehole sunk to an additional depth of 350 feet yielded 2½ to 3 million gallons in addition. Both wells were sunk in the pebble beds and lower mottled sandstone of the Bunter formation. By an arrangement designed by the Engineer, the borehole water in each case is fully controlled and kept apart from the water produced from the wells. A large pipe of the same diameter as the boring (24 inches), provided with a steel shoe, was forced down a short distance into the borehole, and effectually secured and made water-tight at the bottom of the well. The pipe was then continued up the well to above the rest-level of the water. This allowed the borehole water to have a free head, and prevented the pressure of water in the borehole from forcing its way into the well. The water in the borehole was controlled by a sluice-valve worked from the surface, and by this means repairs to the pumpwork were facilitated. The depth of boreholes varies considerably in different districts. In some, water in abundance is met with at moderate depths, while in others great depths have to be sunk before the quantity required is obtained. In a boring made in the abattoir of Grenelle, in Paris, 1800 feet was reached, and the borehole tubed to a depth of 1770 feet; and although commencing with a 20-inch hole, it was gradually reduced until at that depth it was only 6¾ inches in diameter. Another example of a deep boring sunk in the new red sandstone occurred in Bavaria, where a depth of 1878 feet was reached. Some borings on the Continent are of still greater depth—reaching in some cases to 2800 feet; and in the case of the Bootle borehole of the Liverpool Corporation, a depth of more than 1300 feet was bored in the new red sandstone. Opinions differed considerably, at the time this work was done, as to whether the Corporation ought not to have continued the boring further; some contending that no good result would be obtained by increasing the depth, while others maintained that plenty of excellent water would be met if the boring were taken deeper. However, the boring was stopped at that depth, and the Corporation subsequently carried out the stupendous and successful work known as the Vyrnwy scheme. I think it also worthy of mention that it has been recently recorded that, in the arid districts of Australia, various boreholes have been sunk, resulting in artesian supplies which make many hundreds of square miles of land hitherto unwatered available for agricultural and pastoral purposes. Of these the Gil-Gil boring, 2900 feet (?) deep, yields 2 million gallons of water per day; and of three borings sunk on what is called the Boatman Estate, the first, 1511 feet deep, yields nearly 4½ million gallons, the second and third, sunk respectively 1900 feet and 2100 feet deep yield 3 million gallons each per day. In estimating the cost of carrying out works of well supply, there are so many contingencies, that great anomalies are often met with in unknown districts; and only an approximate estimate can be arrived at in cases of localities of known geological formation. A comparison of tenders shows that even experienced contractors differ considerably in estimating for this class of work in rocks which have been previously tested by trial borings. The difference, no doubt, occurs principally in cases where the contractor is required to keep the works clear of water during construction. In providing pumping-engines for this class of work, the modern engineer has now a variety of choice; for along with the development of water-works, improvements in pumping

machinery have steadily gone hand in hand—resulting in greater efficiency and economy in working.

Storage of Well Water.—The water pumped from wells is generally delivered into a service reservoir situated at a sufficient elevation to supply water by gravitation to the highest parts of the district to be served. It should have a capacity of from three to four days' supply, though this is not always considered necessary in cases where a number of pumping-engines are delivering water into the same reservoir, as it is not thought likely that the engines would all break down or require repairs necessitating stoppage at the same time. But it is a wise and prudent provision to construct reservoir capacity equal to that just stated, as it enables the engineer to conserve the supply during periods of minimum demand to cope effectually with periods of maximum demand. Service reservoirs for the storage of well water should always be covered, as experience has proved that water rapidly becomes impure on exposure to the sunlight, owing to the rapid growth of vegetation. Various methods have been tried in open reservoirs to obviate this—one of them being the keeping up of a constant stream of fresh water. But so rapid is the growth of vegetation, that a few hours of sunlight may suffice to spoil millions of gallons. This undesirable result is prevented by covering the reservoirs.

Water Supply from Rivers, Streams, and Lakes.—Many of the principal towns in this country derive their supply from lakes, the head waters of rivers and their tributaries, and drainage areas. The water is impounded by throwing embankments of earthwork or masonry across the valleys. Before works of this class can be efficiently carried out, many important points have to be examined before the site and capacity can be determined upon—such as the area of the watershed, the rainfall of the district (especially during a succession of three dry years), the nature of the surrounding soil, and its geological character in regard to its capacity for absorbing rain and allowing the infiltration of water through it, and the compensation to be provided for land and mill owners likely to be prejudicially affected thereby. The best authorities on catchment supplies consider that the reservoirs when full should have a capacity of not less than 150 days' supply; and

$$\text{Hawksley's formula, } \frac{1000}{\sqrt{\text{inches per annum}}} \text{ (taking}$$

the average of three consecutive dry years) = number of days' storage, gives a larger result even than this. Many catchment systems, however, for the supply of towns contain more than 150 days' supply. But, on the other hand, many of much less capacity; and these in periods of extreme drought cause considerable anxiety to the management. A system of filtration generally accompanies works of this character, The cost of catchment works, with contingent expenses, is much greater in construction than works of well supplies; but they are less costly for maintenance afterwards, as with a well system an annual charge is incurred for wages of enginemen and stokers, and for fuel, stores, and repairs. It may not be out of place for me here to quote the words of that eminent Engineer, the late Mr. Thomas Hawksley, in his address to the National Association for the Promotion of Social Science at Liverpool in 1876, and referred to by Mr. Arthur Silverthorne in his treatise on provincial water supplies:—

> To provide a town with water of a suitable quality is now a matter of great difficulty and expense. Competent and available sources are becoming fewer and fewer, and must in general be sought at distances always becoming more remote. Moreover, the value of land, labour, and materials is almost day by day enhancing, and so rapidly and steadily that the present cost of a reservoir is, as I know by repeated experiences, double what it was less than thirty years ago. Indeed, the present average expense of procuring and distributing a gravitation supply of a million gallons per day, obtained from a distance of only 10 miles, is rarely less than £160,000, and not very infrequently even a larger sum. Taking into account the interest on the capital invested, the redemption money, the repairs and maintenance, the rates and taxes, the working expenses, and the incidental disbursements, the cost of a million gallons per day thus obtained commonly enough amounts to £12,000 a year; and hence the cost of 1000 gallons of water now amounts to nearly 9d. net, whereas in my bygone days 4d. or 5d. per 1000 gallons was considered a rather extravagant charge.
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> And what was of so much importance twenty years ago, is now of still greater importance. It causes grave anxiety to local authorities and their officials in their endeavour to supply the wants of an ever-increasing population.

Distribution and Management.—In laying down the distributing mains and services in a town, a good deal of thought and judgment, as well as experience, is necessary in determining the sizes of pipes and the mode of arrangement. In proportion as this is well done, so likewise will the result be comfort and satisfaction to the management; but if badly arranged, annoyance and dissatisfaction are the result. Much might also be said on the benefits of constant service—of which the late Mr. Thomas Hawksley was proud to say he was the father—the causes of waste and the various modes adopted for reducing it to a minimum, comparisons between the purity and hardness of water obtained from deep wells and from drainage areas, and the detail cost of pumping. But as I desire to limit the scope of this address, I commend these matters to the consideration of the members, in the hope that at some future time they will contribute papers on their varied experiences, and that useful and profitable discussions may ensue.

Demand per Head per Day.—Since the passing of the first Public Health Act of 1848, the demand per head per day for water is a gradually increasing quantity. The adoption of the water-carriage system, and the more modern habits of cleanliness due to the extended use of both public and private baths, assist in raising the standard required for domestic use and sanitation; and the efforts of the analytical chemists, who are constantly developing and increasing their knowledge, are of considerable importance in securing to the public a greater measure of protection over the purities of our supplies, which was little thought of many years ago.

The Nottingham Water-Works.—As during the course of this conference the members of the Association will have the opportunity of visiting the principal pumping-stations of the Nottingham Corporation, I now propose to give a short description of the works, the mention of which must of necessity bring forward the name of the late Mr. Thomas Hawksley, about whom a more than passing reference must be made, owing to his intimate connection with these works until they became the property of the Corporation in 1880. [The President read an extract from the Obituary Notices of the Institution of Civil Enigineers, giving a sketch of the career of the late Mr. Hawksley.] In 1830, he undertook the construction of the new water-works for Nottingham, the first supply of which town had been given much earlier by a Company who took their water from the River Leen, near the Castle, and subsequently from springs at Basford. But these works being insufficient, Mr. Hawksley was made Engineer to a new scheme called the Trent Water-Works, with a pumping-station adjoining the river at Trent Bridge, whence the water was obtained by filtration through natural beds of sand and gravel. In 1845, the two Companies amalgamated by Act of Parliament; and Mr. Hawksley then took charge of the joint enterprise, which bore the name of the Nottingham Water-Works Company. He afterwards constructed more extensive works for obtaining water from wells in the new red sandstone. In the course of time, the water at the Trent works and that from the Basford or Scotholme springs became impure, and was abandoned; and eventually the Park, the Basford, and the Bestwood pumping-stations were erected.

The Park pumping-station, erected in 1850, consists of two 7 feet diameter wells, sunk to a depth of 225 feet, connected by a driftway, in which boreholes are sunk to a further depth of 100 feet. The engine is a beam engine of the Cornish type, 60 nominal horse power, with a 49-inch diameter cylinder and an 8-feet stroke, actuating double lift-pumps, each 10 inches in diameter, delivering into a tank. The lift-pumps are connected by a cross-head with a ram-forcing pump working between. This station is not now in use, as the water is excessively hard, and considered to be of doubtful character.

The Basford pumping-station was erected in 1858, and extended in 1869. The works put up in 1858 consist of a well 9 ft. 4 in. diameter and 110 feet deep. Duplicate engines of 60 nominal horse power are erected over this well, and are compound rotative beam engines, each having high-pressure cylinders $18\frac{3}{16}$ inches diameter, with a 4 ft. 6 in. stroke, and low-pressure cylinders $31\frac{13}{16}$ inches diameter, with a 6-feet stroke. The bucket lift-pumps are 15 inches in diameter with a 5-feet stroke; the ram forcing-pumps are $17\frac{1}{2}$ inches in diameter with a 3-feet stroke. There are, in addition, small bucket lift-pumps, 9 inches in diameter with an 18-inch stroke, fitted to each engine, and used for pumping to higher levels than the main force-pumps. Steam is supplied by three Lancashire boilers, each 24 feet long and 7 feet in diameter, with a boiler pressure of from 50 to 55 lbs. per square inch. The works erected in 1869 consist of a 6 ft. 10 in. diameter well sunk to the same depth as the first well, and connected to it by a driftway in which are boreholes about 75 feet deep. The engine at this well is a rotative condensing beam engine of 100 nominal horse power, having a cylinder 42 inches in diameter with a 6 ft. $11\frac{1}{2}$ in. stroke. The lift bucket-pump is 20 inches in diameter and 6-feet stroke; the ram-forcing pump is $25\frac{1}{2}$ inches in diameter and 3-feet stroke; and a small bucket lift-pump is 12 inches in diameter and 18-inch stroke, for pumping to higher levels. Steam is supplied at a pressure of from 22 lbs. to 25 lbs. by four Cornish boilers, each 24 feet long by 5 ft. 6 in. diameter. The yield from this station is close upon 2 million gallons per 24 hours. The grounds, $3\frac{1}{2}$ acres in extent, are ornamental in character; and the cooling-pond forms a prominent and pleasing feature.

The Bestwood pumping-station, erected in 1873, consists of one indoor and one outdoor well, each oval in shape, 16 feet by 7 feet, and 186 feet deep. The tunnels or driftways at this station have an aggregate length of 2493 feet; and 29 boreholes are sunk in them, varying in size from 4 inches to 12 inches in diameter, and from 96 feet to 110 feet deep. Duplicate engines, each of 125 nominal horse power, are in use at this station. They are rotative condensing beam engines, having cylinders 50 inches in diameter and 8-feet stroke. The bucket lift-pumps are $22\frac{1}{2}$ inches in diameter with an 8-feet stroke; and the ram forcing-pumps 30 inches in diameter with a 4-feet stroke. Steam is supplied at a pressure of 36 lbs. by six Lancashire boilers, each 32 feet long by 6 ft. 6 in. diameter. The yield from this station is about 2 million gallons per 24 hours. The grounds, with cooling-pond about six acres in extent, have a striking and pleasing appearance; while the buildings are bold in design and substantially built.

The Papplewick pumping-station, designed and carried out by the late Mr. M. Ogle Tarbotton, M.Inst.C.E., of Nottingham, was erected 1884, and consists of indoor and outdoor oval wells, each 16 ft. by 8 ft., sunk to a depth of 200 feet. The tunnels or driftways at this station have an aggregate length of 1216 feet, and have eight boreholes sunk in them to depths varying from 70 to 90 feet. The duplicate engines, each of 130 nominal horse power, are rotative condensing beam engines, having cylinders 46 inches in diameter and 7 ft. 6 in. stroke. The bucket lift-pumps are 20 inches in diameter and 7 ft. 6 in. stroke; and the ram forcing-pumps are 27¼ inches in diameter and 3 ft. 9 in. stroke. Steam is supplied by six Lancashire boilers, each 28 feet long by 7 feet diameter, at a pressure of 40 lbs. per square inch. The yield from this station is a little over 2 million gallons per 24 hours. The grounds, about eight acres in extent, are, like the other stations described, ornamental in character, with buildings to correspond.

The recording arrangements in connection with the Nottingham Water-Works system are very complete; each engine-house having registering apparatus showing the level of the service reservoirs they serve. At the same time, the levels of all the reservoirs are recorded in the Chief Engineer's office in the town.

There are seven covered service reservoirs in connection with the water-works, having a total capacity of 9,700,000 gallons. The reservoirs are as follows: The Park Row reservoir, with a capacity of 2,202,034 gallons, supplies the lower zone, and receives its supply from the larger of the engines at the Basford pumping-station. The Belle Vue reservoirs (two), with a capacity of 2,248,368 gallons, serving the middle and principal zone, are supplied from the Basford pumping-station, and by gravitation from the Red Hill and the Papplewick reservoirs. The Red Hill reservoir has a capacity of 1,938,876 gallons, and receives the water from the Bestwood pumping-station, and by gravitation from the Papplewick reservoir. This reservoir supplies in part the higher zone. The Papplewick reservoir, with a capacity of 1,487,394 gallons, receives the water from the Papplewick pumping-station, and supplies by gravitation either the Red Hill reservoir or the reservoirs serving the middle zone. At the Papplewick station, there are also auxiliary pumps pumping over a stand-pipe which supplies the north-western portion of the Corporation's water area. The Mapperley reservoirs (two) have a capacity of 1,823,267 gallons, and receive their water from the Basford pumping-station; and they furnish a supply in part to the higher zone. The parliamentary area of supply is 67¾ square miles; and there are 270 miles of mains. The total quantity of water pumped and distributed per annum in 1881 (the year after the works were taken over by the Corporation) was 1248 million gallons, supplying an estimated population of 191,753; and the present consumption is 1,990,333,300 gallons per annum, supplying an estimated population of 250,543. The quantity used per head per day for all purposes in 1881 was 17·82 gallons, of which 6·30 gallons were for trade purposes. The present consumption per head per day is 21·41 gallons, of which 7·46 gallons are employed for trade purposes.

Mr. H. Ashton Hill (South Staffordshire Water Company) said the address to which they had listened was one which, he was sure, they had all appreciated very much. Those of the members who had had to prepare presidential addresses knew how difficult it was to select suitable matter. He thought in this case their President had hit upon the right line. He might say with regard to the bore-holes and works generally for the supply of St. Helens, that the President had said something about the Engineer; and he (Mr. Hill) supposed it was their President's modesty which prevented him saying that he was himself the Engineer. He could assert that the works stood as a monument of the skill of their President. As they had heard, one of the wells yielded the large quantity of 4 million gallons of water per day; and many present would be pleased to have such an installation. Mr. Gaskin designed the whole of the works—the machinery was second to none; and the buildings were highly ornate constructions. Mr. Hill concluded by moving a vote of thanks to the President for his address.

Mr. W. Matthews (Southampton), in seconding the motion, remarked that the President in his address had (one might almost say) given them a rather overwhelming programme. The number of subjects he had indicated as being worthy of their attention was very large; and he (Mr. Matthews) had no hesitation in saying that—trivial as certain of them might appear to some members—they were all worthy of a great deal of attention at their hands. Before concluding, he suggested that the members should contribute to the Association printed matter in the way of their annual reports; and, if they came across old books connected with water engineering, instead of keeping them hidden away, they should make them public property, by placing them in the custody of the Association.

The motion was carried by acclamation, and briefly acknowledged.

Additions to the Roll.

The Scrutineers reported that they found from their examination of the ballot papers that the following gentlemen had been admitted to the Association:—

Members.—Messrs. A. Oddy (Pontefract), J. S. Pickering (Nuneaton), W. Ingham (Torquay), W. Williamson (Burnley), W. Jones (Pontypridd), E. J. Silcox (King's Lynn), W. Gray (Birmingham), F. W. M'Culloch (Belfast), A. T. Walker (Reading), and King (Epsom). Mr. H. Preston (Grantham) was also subsequently elected.

Associates.—Messrs. C. H. H. Adams (Guildford), C. L. Simpson (London), Whitaker (Southampton), A. A. Garside (Cardiff), W. Pare (Rushden), C. J. Hobbs (London), R. J. Hartley (Halifax), T. E. Milton (Birmingham), H. Lupton (Leeds), A. J. Jenkins (Rochdale), J. L. Bonnar (Dunfermline), A. Towler (Leeds), C. E. De Rance (Stoke-on-Trent), W. T. Currey (Newport), and J. O. Evans (Wolverhampton).

Papers Read.

The reading of the papers (of which the principal portions will be published in succeeding issues of the "Journal") was then proceeded with. Those read on Tuesday were: (1) "The Interpretation of Results of the Chemical Examination of Water," by Professor F. Clowes, F.I.C. (2) "The Stockport Water-Works: Description of Borehole, &c., near Wilmslow," by Mr. T. Molyneux. (3) "Hydro-geology and Hygiene," by Mr. C. E. De Rance. (4) "Notes on Sinking and Timbering Concrete and Puddle Trenches for Reservoir Embankments," by Mr. W. Watts. (5) "Discharge Tunnels for Reservoirs with Valves fixed Therein," by Mr. James A. Paskin.

On Wednesday morning, the remaining papers were taken in the following order: (6) "The Halstead (Essex) Water-Works Extension," by Mr. Percy Griffiths. (7) "The Use and Misuse of Water," by Mr. R. E. W. Berrington. (8) "Some Causes of Failure in Service Mains and Pipes," by Mr. J. Shaw. (9) "Waste of Water in its Relation to Lead Service-Pipes," by Mr. O. J. Kirby.

Appointment of a Committee to Watch Legislation Affecting Water Undertakings.

Upon taking the chair on Wednesday,

The President said he wished to draw attention to a matter of some importance to water authorities. In Mr. De Rance's paper, it would be found that the author referred to county authorities having control of water-works; and upon that point, he made these remarks:

> The writer is of opinion that, looking to the complexity of the existing water law, vested interests in the parliamentary costs of obtaining the existing powers, and the far larger capital expended in carrying out works so sanctioned, for various purposes affecting water on the one hand, and the necessity of dealing with the same for the public good on the other, that decisive, but progressive, steps in legislation are absolutely requisite, and is of opinion that the varied, and often antagonistic, requirements, and the necessary funds to deal with various interests, cannot be incorporated in any General Act of Parliament; and he ventures to suggest that it is advisable that—(1) County Councils, or groups of the same, be given powers by Parliament to form "Water Boards;" (2) that such Boards have power of control of all water within their area in three stages: (*a*) direct; (*b*) with Local Government Board sanction, after local inquiry at the suggestion of the local authority; (*c*) after parliamentary inquiry and approval of the modification of existing rights and previous Acts, subject to monetary compensation when rights, exercised under parliamentary powers, were affected.

He (the President) thought that the Association should take up a matter of this kind. He believed that other societies were working in this direction; and there was no reason why their own Association should not have "a finger in the pie." He would therefore suggest that a Sub-Committee should be appointed, in order to keep this matter in view, and to report from time to time at either a special or the annual meeting of the Association. The subject to which Mr. De Rance had referred was certainly coming to the front; and water engineers were fully alive to the changes in legislation which affected them as well as the communities which they served. He further suggested that the Sub-Committee should consist of himself as the President and the two Vice-Presidents (Messrs. H. Ashton Hill and W. Matthews), with any other gentlemen who kept themselves posted up in these matters.

Mr. R. E. W. Berrington (Wolverhampton) admitted that the President's suggestion was an excellent one; but he asked for information as to the specific duties that would devolve upon the Committee. He thought with Mr. De Rance that a Government department should set aside watersheds for different authorities. Concerning the reference to County Councils, he inquired whether it was proposed to include County Borough Councils. The same Committee, he suggested, should also consider the law with regard to underground water. Whatever their opinions might be as water-works or municipal engineers, they could not help feeling there was a little injustice with regard to the common law of the land in respect to underground water. To deprive people of their ordinary drinking water for ten or fifteen miles without some compensation was rather hard. He had sufficient confidence in the members of the Association to know that they would regard this question from a common-sense point of view.

The President pointed out that his proposal was simply to appoint a kind of Watching or Vigilance Committee to keep in view the matters to which he had referred as they were brought forward, and to report from time to time, so that the Association could decide as to the course they should pursue in regard to them.

Mr. J. Lees (Tonbridge) moved that the President and Vice-

Presidents be appointed a Sub-Committee for the purposes named by the President.

Mr. C. GILBY (Bath) seconded the motion.

Mr. BERRINGTON suggested that Mr. Paskin, of Halifax, be added to the Sub-Committee.

This proposal was adopted; and the motion was then unanimously carried.

VOTES OF THANKS.

At the conclusion of the reading of the papers, the Secretary was instructed to write to the Mayor of Nottingham acknowledging his kindness in allowing the Association the use of the Exchange Rooms for the meeting; and afterwards the President was heartily thanked for his services in the chair.

This ended the business before the meeting.

VISIT TO THE NOTTINGHAM PUMPING-STATIONS AND ANNUAL DINNER.

More than fifty of the members and their friends availed themselves of an opportunity to visit the Basford, Bestwood, and Papplewick pumping-stations of the Nottingham Corporation during Wednesday afternoon. Starting from the George Hotel shortly after two o'clock, the party drove first to Basford, where they were photographed. Later Bestwood and Papplewick were visited; and at the latter place, the party was entertained to tea by the President and Mrs. Gaskin. The machinery and general arrangements at all three stations were minutely inspected and much admired.

In the evening the first annual dinner was held at the George Hotel. The chair was taken by the President, who was supported on his right by the Mayor, and on his left by the Sheriff (Mr. John Wright). Among the guests was Mr. W. R. Chester, the Manager of the Gas Department of the Nottingham Corporation, and Ex-President of The Incorporated Gas Institute. Several toasts were submitted; and, in the course of the speeches, the energy and ability which the Secretary (Mr. W. H. Brothers) has displayed since his appointment were freely acknowledged.

EXCURSIONS.

The members were early on the move on Thursday morning—having before them the prospect of a pleasant day's outing; and in this they were not disappointed. Carriages were in attendance at the George Hotel at 10 o'clock, which conveyed the members to the works of the Humber Cycle Company and those of the Stanton Iron Company, Limited. At the latter place, the visitors were entertained by the Directors at a *recherché* luncheon, at which Mr. Crompton, one of the members of the Board, presided. The return journey was made through delightful country; the route traversed taking in the three counties of Derbyshire, Leicestershire, and Nottinghamshire.

On Friday, a number of the members wound up the week by visiting the far-famed "Dukeries."

The Estimation of Sulphur in Coke and Coal.—Stolba describes, in a recent number of "Glückauf," a modification of Eschka's method of determining the sulphur in fuels, which he has found to give good results. He mixes one gramme of the coal or coke with a gramme of fine reduced silver and a gramme of sodium hydrogen carbonate. The mixture is heated in a platinum crucible by a spirit-lamp until particles of the fuel are no longer visible. The residual mass is heated with ammonium nitrate, treated in a flask with hydrochloric acid, and filtered. The sulphuric acid in the filtrate is estimated as the barium salt, and the amount of sulphur calculated therefrom. Coal needs heating for 20 to 25 minutes; but coke, for 30 to 40 minutes. The heating must not be performed by a coal-gas flame, on account of the sulphur present in the gas. The silver may be recovered by treating the residue with hydrochloric acid, and afterwards boiling and extracting with caustic alkali and sugar.

The Effect on Animal and Plant Life of the Gases from Brown Coal.—The subject of the gases and effluents from the manufacture of paraffin and mineral oil has lately been dealt with in the "Chemiker *Z*eitung;" and in the course of the article reference is made to the effect upon animals and vegetation of the gaseous impurities resulting from the processes employed. Brown coal is decomposed in vertical cylinders; and at a red heat the elementary constituents of the coal are resolved into the so-called permanent gaseous hydrocarbons, especially illuminating gases. In addition to gaseous impurities, the atmosphere of lignite carbonizing works is frequently contaminated with particles of coke dust, the inhalation of which gives rise to pulmonary complications, and injury to the mucous membranes. The effluents, on the other hand, if free from tar and particles of coke, exercise a beneficial influence on vegetation. The conclusions drawn indicate the fact that the gases derived from the destructive distillation of brown coal are detrimental to animal and vegetable life, unless they are diluted with a sufficient quantity of pure air, in which case it is estimated that at the most only 25 to 30 metres of the adjacent land would be exposed to the influence of the escaping gases. Beyond this distance, it would be impossible to discern any prejudicial result.

THE BEHAVIOUR OF SULPHUR IN COAL GAS ON COMBUSTION.

The degree of oxidation which the sulphur in coal gas undergoes when the gas is burnt, has always been one of the open questions of analytical chemistry. The bulk of experimental evidence has favoured the view that nearly the whole of the sulphur present is completely oxidized to sulphuric acid under the ordinary conditions of gas consumption. The evidence available at the time the Metropolitan Gas Companies were first required to remove all but a small amount of sulphur from the gas they distributed, was by no means conclusive; and the matter has recently, as already mentioned in our columns, formed the subject of papers in the "Zeitschrift für Analytische Chemie." Uno Collan last year attempted to disprove the general conclusion that the sulphur in gas is almost wholly and directly burnt to sulphur trioxide or sulphuric acid. He asserted that when sulphur dioxide was led into an alkaline solution, in presence of oxygen, it was easily oxidized to sulphur trioxide; and that therefore, as earlier experimenters had absorbed the products of combustion in alkali, their results were worthless. He satisfied himself that neither unburnt coal gas nor the products of combustion of gas free from sulphur, exercised any reducing action on chromic acid solution. He then passed the products of combustion of 50 litres of coal gas into a standardized solution of chromic acid. At the conclusion of the experiment, he determined the sulphuric acid in one portion of the solution, and the chromic acid remaining unreduced in another. He found that the amount of chromic acid reduced corresponded in four experiments to 93, 89, 99, and 93 per cent. of the total sulphur present as sulphur dioxide or sulphurous acid in the products of combustion. Three trials were made with a luminous, and one with a non-luminous, flame. Collan concluded that the chief product of the combustion of the sulphur in coal gas is not sulphuric, but the comparatively harmless sulphurous acid.

This conclusion has been controverted by results given in a paper more recently published in the same journal by Maximiliano Dennstedt and Cæsar Ahrens. These gentlemen have repeated Collan's experiments with some additional precautions, and have found fairly consistently an amount of chromic acid reduced corresponding to 80 per cent. of the total sulphur in the gas being burnt to sulphur dioxide only. Their tests showed, however, that the accuracy of the method of estimation was open to suspicion. They next repeated the experiments with seven moistened flasks inserted between the condenser and the chromic acid absorption apparatus. The products of combustion were thus exposed to the influence of moist air before absorption; and sulphuric acid was found to have condensed in each flask. The ratio of sulphur to oxygen was then varied by drawing in oxygen in place of air in one set of experiments; and as much as 37 per cent. of the sulphur in the gas was then found to have been directly burnt to sulphuric acid. In another set of experiments, vapour of carbon disulphide was admitted in known quantity to the gas; and the proportion of sulphur dioxide to the total sulphur in the products was then found to have increased. Dennstedt and Ahrens have concluded from these experiments that, when coal gas is burnt under ordinary conditions, the free access of oxygen and moisture lead to the rapid oxidation of the sulphur dioxide to sulphuric acid, and that therefore it is of little importance that the conversion to sulphuric acid may not take place wholly and directly in the flame itself. The fact that sulphuric acid is actually formed from nearly the whole of the sulphur in the gas is considered to render necessary as complete a removal as possible of sulphur compounds from gas; and the fact that the formation takes place at a distance from the flame itself is deemed of minor importance.

The Kent Coal-Field.—Preliminary operations in connection with the coal borings between Folkestone and Dover having been completed, the actual work of sinking the first shaft was commenced on the 14th inst.—day and night shifts of workmen being employed. The second shaft is to be commenced forthwith over the side of the original boring which was sunk for 2000 feet.

Proposed Formation of a Non-Tidal Thames Conservancy Board.—A proposal has been brought forward by the Thames Floods Prevention Committee for the formation of a Board to whom is to be entrusted control of the non-tidal portion of the river. The Board will consist of representatives of the County, Town, and District Councils, as well as the Councils of riparian parishes, in the area affected. It is suggested that the revenues now derived from the London Water Companies shall be handed over to the new authority, together with all tolls and dues collected on the non-tidal river. This arrangement would furnish a substantial income. The scheme has been set out in a memorial to the President of the Board of Trade, which has been circulated among the various public bodies along the Thames Valley, with the object of ascertaining their views on the subject. If these are at all favourable, Parliament will be approached to obtain their sanction to the scheme. In the meantime, something will doubtless be heard from the Thames Conservancy thereon.

REGISTER OF PATENTS.

Gas-Engine for High Speed.—Melhuish, A. G., and Beaumont, C., of Peckham. No. 11,925; June 19, 1895.

This gas-engine is so constructed that the air required to form the combustible mixture is drawn into a chamber by the instroke of a piston working in a cylinder closed at both ends, and forming a partial vacuum at one end of the cylinder during the in-drawing of the gas into the chamber. It is retained separate from the charge of air, which enters at the termination of the piston's instroke and destroys the vacuum; the air so entering being compressed on the next out-stroke of the piston into a pipe, within which the gas chamber is preferably fitted. It has free communication with it, however, so that the gas itself is compressed to the same degree, but kept quite separate from the air, with which it only mixes to form a combustible charge when it enters the working end of the cylinder, so as to drive out the products of the previous explosion.

The working piston is preferably connected by a rod to a guide-piston, which may be used as a pump to compress air into a reservoir for use in starting the engine; the pressure being utilized to keep the connecting-rod down upon the crank during the return stroke.

The method of controlling the engine consists of a governor which controls a small valve connected with the gas-inlet. It is arranged in such a manner that the gas-valve is always either fully open or shut; and by this means, "if an explosive charge is introduced, it is always of the most efficient value." In connection with the gas-valve is a small piston, which, when the top side is open to the atmosphere, admits the gas by the action of the governor; and, when the engine exceeds its proper speed, the top of the piston is put in communication with the underside of the valve, and is in equilibrium, but kept in position by a spring. If the engine is running at the proper speed, an explosive mixture is introduced at every revolution; but if the speed is exceeded, only air is admitted.

Prepayment Gas-Meters.—Tourtel, J. M., of West Kensington, W. No. 14,198; July 25, 1895.

This invention relates to attachments for gas-meters in which, upon the insertion of a coin, mechanism may be set in action which will successively lift and move away from its initial and operative position a gas cut-off device, adapted to engage with the teeth of a ratchet or toothed wheel, or with the pins of a pin-wheel, by which it is held in the position to which it has been removed in relation to the wheel, and by which it is returned to its operative position with a speed proportional to that of the meter mechanism with which the wheel is in gear, or of which it may form a part. By causing the cut-off to step back over the wheel to a greater or less distance, by the insertion of a number of coins equivalent to that distance, the meter or its mechanism may be set to supply a proportional quantity of gas before the supply of the latter is cut off.

The present invention relates, firstly, to the construction of the step-back action of the cut-off device, and to means for enabling the coin itself to cause the operation of the step-back action. The second part of the invention is applicable to that form of step-back action in which the cut-off—a lever whose fulcrum coincides with the axis of the ratchet-wheel—carries two pawls engaging in a particular way with the teeth of the ratchet-wheel. The coin itself, by its insertion in the slot provided for it, is caused to operate the successive lifting or releasing of two pawls, in order to permit them to step back over the teeth of the ratchet-wheel under the influence of a constantly present and automatically operating force, so that the consumer need not perform any further action than the placing of the coins in the slot.

Fig. 1.

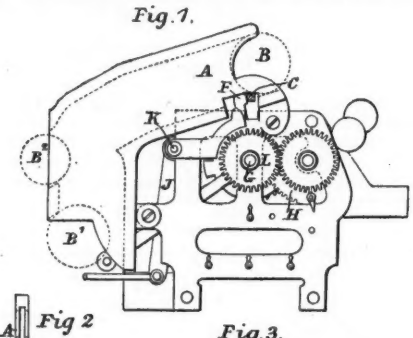


Fig 2

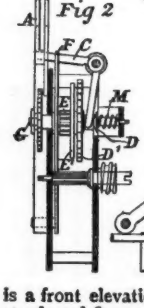


Fig. 3.

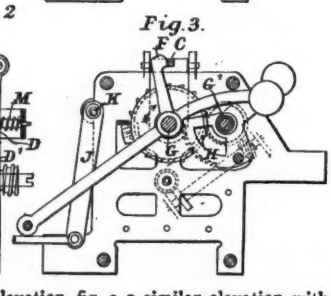


Fig. 1 is a front elevation, fig. 3 a similar elevation with the front plate removed, and fig. 2 an end elevation of the apparatus as applied in a form of meter in which the introduction of the coin directly operates the mechanism.

A is a shoot; and upon a coin being inserted into it at B, an arm C of a bell-crank lever is forced down, and is secured by the hook F of a three-armed lever, which is forced over it by a balance-weight on the arm of the lever. The coin then falls through the shoot; and upon reaching the position B^1, it strikes the pin on the arm of the lever, and releases it from the hook. When one arm is forced down, the other is forced outwards, and carries with it a recessed sleeve D, which is connected by a key or feather to the arbor G, and against which presses a spiral spring M. Upon the sleeve is fixed a rachet-wheel; and with the teeth of this wheel engage two pawls or detents, fixed upon a disc mounted loosely upon the arbor. A pinion E upon this disc engages with a segment-rack H, mounted loosely on the arbor G^1; and a balance-weight on the rack tends to turn the disc through the pinion, and keeps the particular detent of the disc which is at the time engaged with the rachet-wheel against the radial face of the tooth nearest to it. The arbors G G^1 are geared together by the wheels L L^1, which are secured to their respective arbors by nuts. Upon the other extremity of the arbor G^1 is fixed a wheel which is actuated by the ordinary meter-index. By this means the ratchet-wheel on the sleeve D is always turned in the direction of the arrow in fig. 3; and the disc on the pinion E is alternately set back for a distance of one tooth of the wheel for each coin inserted, and returned to its normal position as the gas is consumed.

In order to cut off the supply of gas when the quantity prepaid has been consumed, there is provided upon a lever fixed on the axis K a projection; and a second lever J (also fixed upon the axis K) is connected by means of a rod to any suitable form of valve. A projection upon the disc E^1 is arranged to engage with the projection on the lever K^1; and as the disc E^1 is turned with the rachet-wheel D^1 in the direction of the arrow, the valve is closed, and the supply of gas cut off. A tongue on the lever K^1 is arranged to enter into the shoot A when the valve is closed; and thus the coin, after operating the arm C is enabled to press down the lever K^1 and open the valve.

Upon the rack H is a pin bearing a pointer, which indicates on a scale the number of coins inserted into the apparatus in prepayment of gas. By varying the number of the teeth in the wheel L L^1, the speed with which the ratchet-wheel is rotated can be varied; and thus a greater or less quantity of gas can be supplied for a given coin.

Production of Combustible Gas.—Howell, H., of Brixton, S.W. No. 14,460; July 30, 1895.

These so-called "improvements" relate to apparatus for the production of combustible gas from mineral or other oils or fats, and comprise: (1) A self-feeding furnace, with fuel hopper, damper, and chimney; (2) one or more retorts fixed in the furnace; (3) an oil reservoir with outlet-valve, connected to the retorts by a pipe with branches, which may severally extend inside the retorts to within a short distance of their ends; (4) a hydraulic box, gas washer, and gasholder, either combined or separate, connected with the retorts by pipes; (5) a device whereby the rising and falling of the gasholder shuts off and turns on the supply of oil to the retorts. There is nothing sufficiently interesting in this specification to justify any illustrated abstract of it being published in our columns.

Production of Cyanogen Compounds.—Frank, A., of Charlottenburg, and Caro, N., of Berlin. No. 15,066; Aug. 10, 1895.

In their specification (which is not illustrated), the patentees say: It has been stated before now, by Moissan (in the "Comptes Rendus" for 1894, p. 503), that, when nitrogen is passed over, or in contact with, the heated carbides of calcium, barium, and strontium, no reaction or combination takes place; this statement being based directly upon experiments made with chemically pure carbides. The applicants, however, have ascertained by investigation that nitrogen is absorbed by such chemically pure carbides, with the formation of cyanogen compounds, if conducted in the presence of water vapour, over or in contact with the carbides contained in closed vessels (such as tubes, retorts, or the like), and heated to a temperature approaching that of red heat—the corresponding cyanides being formed. These cyanides will be formed when the carbides of the metals of the alkaline earths (such as calcium, barium, strontium, or magnesium) are employed, and also when the carbides of alkali-metals (such as potassium, sodium, or lithium) are used. So, too, cyanides are obtained when mixtures of the various carbides are used; and the same effect is produced when the carbides contain other substances, such as alkalies (potash, soda), or alkaline earths (lime, baryta, strontia, magnesia), or the salts thereof. In this case, in which chemically pure carbide is not present, the presence of water vapour can be dispensed with. The presence of water vapour is also unnecessary, even with chemically pure carbides, if the nitrogen be applied in a chemically bound or combined form, so that it is given off or liberated as free nitrogen, and can thus come into operation *in statu nascendi*. The carbide mixtures may be prepared either by mixing the several ready-made carbides, or by treating the crude substances or agents required for the production of carbides (such as the oxides or carbonates of the corresponding alkalies or alkaline earths, or the free metals) with the requisite amount of carbon, in any desired or well-known manner, so as, by a direct process, to convert them into carbides; or, again, by mixing the carbides of suitable alkaline earths, or mixtures thereof, with alkalies or salts of alkalies. In preparing carbides from free metal and carbon, experiment has shown it to be advisable—where metals are used which would become volatilized at the temperature needed for the formation of carbides (such, for instance, as potassium, sodium, and magnesium, and also zinc which, chemically, is related to the last-mentioned metal)—to submit such metals, together with the carbon (or coal), to the action of the required high temperature, after confining them in closed vessels. The desired carbide will then be formed as a result of the action exercised upon the carbon by the metallic vapour.

The experiments which have led to the present discovery have shown that if, in carrying out the process above indicated, iron or iron compounds be added to the material from which the carbide is to be formed, the corresponding cyanogen compounds—in the form of their ferro-cyanogen combinations—will be obtained by treating the mixture in the way above described.

The manner in which this invention is to be performed may be better illustrated (say the patentees) by the following examples:—

1.—Barium carbide, obtained in the well-known manner, after being finely reduced or divided, is introduced into a retort of tubular shape,

made of refractory material (preferably fire-clay). The retort should be fitted with suitable means for the admission and discharge of the gases. The nitrogen required for the reaction—which may be air, wholly or partly freed from oxygen—is thoroughly saturated with water vapour. This is absolutely necessary, when employing nitrogen in the free condition with chemically pure carbides. With carbides containing oxides or salts, even in small quantities, or when employing nitrogen in a bound or combined form, however, it is not absolutely necessary. This saturation with water vapour is advantageously effected by conducting the gas through a vessel containing water. After heating the retort nearly to a red heat, the nitrogen, thus charged with moisture, is introduced into the retort. For a charge of from 15 to 17 kilos. of barium carbide, from 2 to 2¼ cubic metres of nitrogen will be sufficient. The nitrogen is preferably introduced into the retort under a moderate pressure, and at a rate or speed enabling the operation to be completed in about two hours. The resulting mass, after cooling, is treated with water. From any carbide that may remain unaltered, acetylene will be evolved, which may be intercepted and collected separately; while barium cyanide will be obtained in the form of a solution, which may be extracted and treated in the well-known manner.

2.—Calcium carbide as such, on being similarly treated, failed to give a satisfactory result. But a mixture of calcium carbide and barium carbide, as well as one of calcium carbide and sodium carbide (obtained in the ordinary manner from soda-lime and carbon), will give the desired result. The product of the reaction, obtained through the joint action of nitrogen and the vapour of water (by a process similar to that described with reference to the first example), may—like the product obtained according to the first example—be washed or lixiviated with water; and any acetylene which may be evolved should be collected separately, while the solution may be further treated with a view to its conversion into cyanide. For this purpose, hydrogen cyanide or hydrocyanic acid may be extracted from the solution by the addition of an acid—preferably by introducing carbonic acid into the solution; and after this such gas (hydrogen cyanide) is brought in contact with the metallic oxide, the cyanogen salt of which it is desired to obtain. Or the desired cyanide can be extracted from the solution by the process of "double decomposition." Thus by an admixture of the carbonate of an alkali-metal, the cyanide of a metal of the alkaline earths may be converted into the cyanide of the corresponding alkali-metal, which remains in solution; the carbonate of such metal of the alkaline earths being obtained in the condition of a precipitate.

3.—Whether barium carbide or calcium carbide be dealt with, the result obtained by carrying out the process more fully described with reference to the first example, may be improved by first mixing the carbides, or a mixture of them (to be treated by that process) with a caustic alkali or an alkaline carbonate, and only subjecting it to the reaction indicated after this has been done. In this modification of the process, the presence of water vapour is not absolutely necessary. The product of the reaction may then be further treated in accordance with the second example.

4.—Carbides of alkalies (such as potassium, sodium, or lithium), whether taken separately or mixed together, will yield the corresponding cyanides, if treated in accordance with the first example, even in the presence of alkaline earths (such as lime, baryta, strontia, magnesia, or the like), or of their salts; the cyanides being separated from the product of the reaction by lixiviation with water.

As regards temperature, a dark red heat has been found favourable to the satisfactory performance of the process. Where a lower temperature is employed, the action of the nitrogen generally proves to be too slow; while a material increase of the temperature beyond the limit stated is apt to occasion partial decomposition and proportionate diminution of the yield.

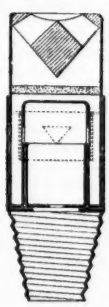
In order to take fuller advantage of the nitrogen, a number of retorts, arranged in succession, or a battery of retorts, may be employed, which arrangement will also enable the operations to be conducted continuously.

Production of Calcium Carbide.—Willson, T. L., of New York, U.S.A. No. 15,360; Aug. 15, 1895. Date claimed under International Convention, Jan. 16, 1895.

This invention refers to the production of calcium carbide by feeding pulverulent and thoroughly commingled carbon and lime into an arc, formed by an alternating electric current of suitable frequency, and by converting the same into calcium carbide by means of such arc. The proposed arrangement was described in the "Journal" for Jan. 15, 1895, p. 120.

Governor Gas-Burner.—Picken, W. B., of West Hampstead, N.W. No. 15,974: Aug. 24, 1895.

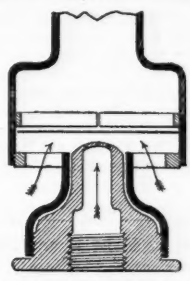
This governor is specially constructed for use with the burner-tip described in patent No. 682 of 1895. Low down in the lower part of the burner is fixed a disc, having a central opening for the ingress of



gas, and a support to the superincumbent governing mechanism, which consists of three parts: (1.) A short hollow cylinder, closed at the upper end, with a narrow flange around the other and open end, fitting closely into the lower part of the case, and resting on the support above described. At a suitable distance from the top of this cylinder, are two small triangular holes, opposite each other. (2.) Another hollow cylinder, fitting easily into the first cylinder, and quite open at the upper end. At the bottom there is only such opening as may be required to admit the desired quantity of gas; and it rests on the same support as the outer cylinder. In this cylinder is placed the usual bit of muslin or other gauze. (3.) A sleeve of wire or other gauze, which fits tightly on the outer cylinder, covering the triangular holes in it. The cylinders are held in position by the upper part of the burner, when it is pressed home. With a given pressure of gas, the inner cylinder acts as a float, rising higher over the holes in the outer cylinder (through which the governed gas escapes), and falling as the pressure diminishes—thus balancing any variation of pressure and automatically governing the gas.

Air and Gas Mixers for Incandescent Burners.—Shillito, T. R.; communicated from C. M. Römpler and H. Axmann, of Erfurt, Germany. No. 19,183; Oct. 12, 1895.

According to this invention, the gas and air mixing-tube (somewhat of the form of a Bunsen burner, but shorter) is formed at its lower end with an enlargement which takes over the gas-jet; and around and just below the orifice of the latter is provided with a perforated horizontal



bottom for the inlet of air for mixing with the illuminating gas. The quantity of inflowing air and the mixing of it with the gas is automatically regulated by a light thin flat metal ring—of aluminium or platinum—which is placed loose over the perforations at the bottom of the mixing-tube, and is caused by the draught from the gas to move (guided vertically) more or less up and down, so that, when the gas is turned full on, the suction will be greatest, and keep the ring lifted up from the perforations, so as to allow of the free inflow of air for mixing with the gas. When the gas is turned down, the suction will not be so great; and the ring not being lifted so much will reduce the inflow of air.

APPLICATIONS FOR LETTERS PATENT.

15,445.—Jones, T. E., "Regulating gas-taps from any distance." July 13.

15,464.—Hill, H. A., and Mitton, T. E., "Reducing-valves for water." July 13.

15,470.—Rigg, A., "Pumps for water or other fluids." July 13.

15,489.—Haviland, F. H., Holloway, A., Collier, J. B., and Murch, W. H., "Production of calcium carbide." July 13.

15,500.—Eiffe, R. J., "Incandescence bodies." A communication from F. Meyer & Co. July 13.

15,561.—Croft, R., "Coin-freed gas-meter apparatus." July 14.

15,579.—Kellner, G, and Faugère, M. M. L. G., "Oil and gas motors." July 14.

15,602.—Boult, A. J., "Gas-generators, and indicating the condition of the fires in the same." A communication from the United Gas Improvement Company. July 14.

15,611.—Waterman, W. G., "Purifying water." A communication from L. Alers-Hankey. July 14.

15,654.—Whalley, D, and Hacking, J., "Acetylene gas store generators." July 15.

15,684.—Thwaite, B. H., and Gardner, F. L., "Rendering iron blast-furnace gases available for working gas motor engines." July 15.

15,709.—Abady, J., and Simmance, J. F., "Pipes for the conduction of water and other fluids." July 16.

15,730.—Anderson, W., "Contra-vibrating fitting for incandescent gas lighting." July 16.

15,757.—Justice, P. M, "Injecting vapour or gas into furnaces." A communication from H. F. Atkinson. July 16.

15,799.—Marriage, T. S., "Lanterns or the like for use in lighting by means of gas or otherwise, and means for supporting the same." July 17.

15,821.—Cockerill, J. W., "Burners and collars of lamps." July 17.

15,854.—Babillot, G., "A permanent gas engine or motor." July 17.

15,861.—Schmidt, E., "Igniting device for gas and other lamps." July 17.

15,962.—Thorn, F. S., and Hoddle, C., "Generating, storing, and cooling acetylene gas." July 18.

Tunbridge Wells Water Supply.—The Tunbridge Wells Town Council have just completed a scheme which will furnish a large additional supply of water from borings made at Pembury, near the reservoirs of the Corporation. The water possesses chalybeate properties which it is desirable should be removed; and the Borough Engineer (Mr. T. W. Mellor), who has given the matter his attention, has recommended the erection of filters at a cost of about £5000. At present the water is simply aërated prior to being turned into the reservoir. The quantity obtained is about 400,000 gallons per day; and the actual cost of the scheme has been £4200.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Testing of London Gas.

SIR,—Either my letter was not clear or Mr. Dibdin has not understood it. I certainly raised no question of his *bona fides* in holding an opinion different to my own on the meaning of an Act of Parliament. My view of the proper interpretation of the testing clauses in all Acts of Parliament was fully set out in my last letter. There has been no attempt at an answer. Consequently, until that view has been shown to be wrong, I shall consider that it holds the field.

I raised the question whether the remarks (which I quoted) made by Mr. Dibdin in his reply on the discussion at The Gas Institute meeting, on his paper on "A Standard Photometer," manifested an impartial spirit. They certainly conveyed to the hearers and to the readers an erroneous idea of the facts; and I endeavoured to supply what was wanting. It is, I know, impracticable to explain everything on such an occasion; but the quoted remarks had no reference to the paper, and there was not the slightest necessity to make them. They were made where the men concerned were not present; and although Mr. Dibdin may not have intended any unfairness, they certainly gave that impression.

Mr. Dibdin has misquoted me verbally in his letter in the last "JOURNAL," and then says gas companies "always can and usually do" know the result of the first test. This is not correct in our case. We can only know it by "shadowing" the tester; and as this is extremely rare, we *usually do not know* anything about the first or any of the tests until we get the report the next morning.

I make no charge of *mala fides* against Mr. Dibdin; and I shall be very glad to learn that the impression created by his remarks is erroneous. But I hold that Parliament intends the gas to be of the prescribed quality at the testing-stations, and not necessarily at the consumers' burners.

July 25, 1896. GEORGE LIVESEY.

Mr. Damon and the Evans Photometer.

SIR,—Having been away on the Continent, I did not see Mr. Damon's letter in the "JOURNAL" for July 7, at the time it appeared; and consequently I could not before this reply to it. I now do so, having had the means of ascertaining, by careful experiment, the amount of weight which ought to be given to his statements. He has, in my opinion, deliberately gone out of his way to make an attack upon one of the two instruments mentioned in the Gas-Works Clauses Act of 1871, and to prejudice public opinion against the Evans photometer and the Dublin Gas Company. In spite of the fact that the House of Lords Committee evidently did not attach the slightest importance to his evidence given against the Company, he writes a letter so full of unsupported assertions and unworthy innuendoes, that it is quite impossible to deal with them all within the limits of a letter of such reasonable length as you might find space for in your columns. I therefore only propose to deal with the statements made by him in his evidence and his letter with regard to that old type of Evans photometer which was adopted by the Gas Referees, and originally prescribed for use by the gas examiners in making their tests of the illuminating power of the gas supplied to London.

This was the instrument which Mr. Damon said, in his evidence before the House of Lords Committee (*vide* questions 5481 to 5493), he took upon himself to alter because it gave "abnormal results." It is remarkable that all his alterations resulted, according to his own statement, in lowering the apparent illuminating power of the gas; so that we have the curious spectacle of an impartial gas examiner making alterations in the photometer because he finds the gas considerably above the prescribed illuminating power. Well! if any gas examiner does this, we shall probably before long have a very curious lot of photometers to deal with.

I know of many instances in which the gas at the testing-stations was found by the gas examiner to be below the standard, when it was abundantly proved to have been at the same time very much above it. I will instance one case. Some years ago, the gas in Jewry Street, in the City, was found by the gas examiner there to be below 14 candles. At the very same time, Mr. Heisch, the late Chief Gas Examiner, found that at Mark Lane, in his laboratory, the gas supplied to the City was equal to more than 17 candles. I have never heard that either he or Mr. Young, the gas examiner, took upon himself to alter the Evans photometer at Jewry Street because the gas gave *abnormally* low results. But they did support the application of the Gas Company to the Gas Referees to have the testing-room removed into Fenchurch Street, on the ground that it was impossible to ventilate the room in heavy or foggy weather. There are other examples I could quote, in which gas made of the illuminating power of 19 and 20 candles at the works was only recorded by the examiner to be equal to 14 and 15 candles. I only mention this to show that it is quite possible, and not at all "abnormal," that the gas might sometimes have been actually 19 or 20 candle gas when Mr. Damon made his tests. But be that as it may, he solemnly says in his evidence that after his alterations the gas fell to 15·7 candles. Possibly it did; and I am not surprised. I even go so far as to say that I should not have been surprised if Mr. Damon had succeeded in getting it down considerably more—a little more judicious tinkering might have done it.

Now, I happened just lately to have been able to obtain an Evans photometer of the exact type of the one originally fixed in the Ladbroke Grove testing-station which Mr. Damon so successfully altered to give results more in accordance with his views of what the gas ought to have been. I have had this instrument, just as it was (with all its so-called defects) fixed alongside a Government Canadian pattern photometer. This pattern, Mr. Damon is probably aware, has been stamped for the Government of Canada by the Standards Department of the Board of Trade. I find that results obtained from careful tests of the same gas in each photometer agree within a small fraction. The gas of The Gaslight and Coke Company shows 16·09 candles in an average of tests made in the Canadian photometer, against 16·23 candles made in this old Evans photometer. I send with this letter a photograph of a pair of Brecknell's candles after having been left burning in this closed photometer for half an hour without opening the doors. You will see that they have been, during the five minutes' exposure, perfectly steady; and when the photograph was taken they were burning exactly as prescribed in the Gas-Works Clauses Act, 1871. I may add that the candles were prepared for burning by carefully turning them round in a horizontal position after lighting, so that the cup might be properly formed, and afterwards left to burn in the photometer for half an hour. The weather was very hot and close; the temperature in the photometer-room being 74° Fahr. It is notable that the candles do not burn quite so steadily in a Letheby photometer, especially if the tester moves about much.

Mr. Damon, or anyone else, may come and verify my results at any time he pleases; and after this I trust we shall hear no more wild statements about the Evans photometer. It is evident that, whatever the cause may have been that led to the results which Mr. Damon deemed unsatisfactory, it was not the photometer.

The inlet of air to the candle side of this Evans photometer is 49½ inches long and ¼ inch in width; the total area being 12·37 square inches. The velocity of the air entering the photometer was 6 inches per second (full). This gives 154½ cubic feet of air per hour passing through the candle side. The cubical content of the candle chamber up to the disc is 4·81 cubic feet. Add to this the cubical contents of the roof, 1·86 cubic feet; and we have a total of 6·67 cubic feet for the entire chamber. The air is therefore changed 23 times per hour, at least, without draught. This is evidently quite sufficient air for any properly prepared pair of candles to burn in. I give these measurements for Mr. Damon's information; and I trust that the next time he gives evidence, he will kindly verify these figures before he condemns the Evans photometer. It is a most useful instrument, and would not have been adopted by the Gas Referees and by so many gas companies and corporations, and prescribed in the Gas-Works Clauses Act, 1871, if it were inaccurate.

The Standards Department of the Board of Trade insist upon all photometers which they stamp being used in a room properly ventilated, and containing not less than 1000 cubic feet of air space. If this recommendation is attended to, there will not be found any difference between the results obtained by the use of the Evans, the Letheby, or the Canadian photometer. But let the photometer be of any type whatever, the candles must be screened from draught, and the reflection from the walls, &c., must be effectually prevented from reaching the disc, if it is desired to obtain accurate results. I think it is very possible that, at Ladbroke Grove, Mr. Damon's results were very much affected by reflection from the walls, which his removal of the top and bottom of the instrument allowed to get to the disc on the candle side. The removal of the top also tended to make the flames of the candles lean towards the disc, besides making them more liable to gutter. Guttering candles always give inaccurate results.

Vincent Works, Westminster, July 25, 1896. WILLIAM SUGG.

[An inspection of the photograph accompanying the above letter fully bears out Mr. Sugg's statement.—ED. J.G.L.]

Low Rate of Interest and the Price of Commodities.

SIR,—In your editorial note on the "Gains of Financing," in your issue of July 21, you quote the views expressed by Mr. John Green at the general meeting of the Union Discount Company, Limited, with regard to the present abnormally low rate of interest.

Mr. Green seemed rather puzzled that the rate of interest remained so low, especially since the "prices of commodities have increased, rather than otherwise." Mr. Green was wrong in his facts; so it is natural that his theories should be rather puzzling. According to Mr. Sauerbeck's figures, as published in "The Times" of July 10, the average price of the forty-five leading commodities reached last June the lowest point on record for this century; and it has fallen continuously since September, 1895. If the average price of these articles during the eleven years 1867-77 be represented by 100, the average price for June, 1896, would be represented by 59·3—a fall of over 40 per cent.

When Mr. Green learns that prices are making fresh records every day, he will probably find his theory agrees with that of all economists of repute. A continuous fall in prices is ruinous to producers, and consequently stifles productive enterprise. Thus the field for the investment of fresh capital is greatly restricted; the rate of interest is lowered; and capitalists begin to compete with one another for the possession of such safe investments as Consols and "gilt-edged" securities.

Manchester, July 23, 1896. DAVID SPENCE.

The Estimation of Nitrogen in Coal Gas.

SIR,—In order that my scepticism respecting coal gas analyses with high nitrogen percentages should not be misunderstood by Mr. Pryce, I would say that I am quite sure that air dilution, such as these analyses indicate, is utterly impossible in certain localities. But I do not on that account believe such dilution to be everywhere impossible, though I hardly think the practice to be (whether accidental or intentional) at all general; and I note that Mr. Pryce is of opinion that such cases are not representative. That is all I want to make clear. They are not representative of coal gas manufacture in this country.

I have twice suggested that Mr. Pryce could give some corroboration to his analyses that show an entire absence of nitrogen (and it will be remarked that he did not confirm these by independent method, as in the case of the others with large proportions of that body) by a statement showing how in such cases the nitrogen is distributed. Such a statement would be the more interesting since the nitrogen-free gas in his case proceeded from a coke-oven. He is apparently unable to do this, and refers to Guéguen—an authority whose experiments were made on a laboratory scale in the early days of the investigation into

the distribution of the nitrogen, and who found that 34 per cent. of the coal-nitrogen went into cyanogen. That is, twice as much as goes into ammonia; about twenty times more than has been found in practice by Knublauch in Germany, by Pendrié in France, and by myself for Midland coals; about seventeen times as much as Mr. Foulis has stated to be probably above the average; and twelve times more than the highest figure given in the paper on "Residuals" we are now discussing.

Mr. Pryce will probably have seen by now that to get the highest yield of ammonia at the highest temperatures, and at the same time to split it up, and get the highest yield of cyanogen, and that too when it is asserted that conditions unfavourable to the production of cyanogen are favourable to that of ammonia and *vice versâ*, is self-contradictory; and that the cyanogen yields in the paper do not add to the validity of Guéguen's distribution. It appears to me that at present the theories of nitrogen distribution for which Mr. Pryce makes himself responsible, while contradicting themselves, do not gain even by the statements of those whose authority he calls in, and are certainly not supported by the more comprehensive work on the subject I have had occasion to cite.

LEWIS T. WRIGHT.

1, *Victoria Street, S.W., July* 20, 1896.

The Incandescent Gas Lighting Question at Dorking.

Writing in reference to a paragraph on the above subject in the "JOURNAL" for the 14th inst., in which it was stated that the District Council of Dorking were anxious to have incandescent gas lighting in the streets, but that the Gas Company declined to move in the matter, the Manager of the Company (Mr. S. Carpenter) says the facts are as follows: "The Company have experimented at their own expense with incandescent gas lighting, and have given the District Council a price which does not include the provision of the burner. The price, although comparing very favourably with other towns in the locality, was not accepted. The Reigate and Redhill Gas Companies are experimenting with the light, but have not yet sent in a price to the Reigate Corporation; so one fails to see in what way the Reigate Companies have been more liberal than the Dorking Company, seeing that the terms were not submitted, even if known, at the date of the Dorking Surveyor's report." It was this report which gave rise to the remarks at the meeting of the Council noticed in our columns; but Mr. Carpenter has pointed out, in a letter to a local paper, that the report contains several mis-statements. Far from being reluctant to move in improving the public lighting, his Directors, he says, have been, and are still, willing to do their best; and they desire to work in harmony with the Council in this matter.

Brighton Water-Works Accounts.—The Water Committee of the Brighton Corporation, in their annual statement of accounts, report that the total receipts for the past financial year amounted to £48,536, of which a sum of £46,984 was in respect of water rates and charges. The total expenditure absorbed £17,471, leaving a gross profit of £31,065. The net revenue account shows a profit balance of £7741, of which sum £7500 will be transferred to the borough fund.

The Profits of the Municipal Undertakings of Blackpool.—According to an editorial note in the "Blackpool Times" upon the finances of the borough in the past year, the ratepayers are very much indebted to the Gas Department, seeing that they would have been (in the words of our contemporary) in a "pretty pickle" had it not been for that source of profit. Upwards of 277 million cubic feet of gas were made; bringing in a revenue of £42,968, and making a profit of £7257—an increase over last year of £1637, equal to 1⅜d. on the rates. The markets show a loss of £249, while the tramways only yielded a profit of £593. The Electric Lighting Department shows a profit of £281, out of £8082 in receipts. These are made up of £2134 for public, and £5761 for private lighting. The number of units produced was 493,824 last year, as against 277,427 in the previous year. The ratepayers will be disappointed if this department does not show a greater profit.

The Public Lighting of Lowestoft.—There was an animated discussion at the last meeting of the Lowestoft Town Council on the subject of the lighting of the borough. The Gas Company submitted a tender, which opened with the remark that the Directors regretted the existing position of the public lighting did not enable them to start on the same favourable terms as many other towns. Their proposals were briefly these: The price of gas supplied to the street-lamps during the year ending June 24 next would be at the rate of 3s. 3d. per 1000 cubic feet. It would cost £350 to put incandescent fittings into the public lamps, which expenditure the Directors were prepared to undertake. The Company were willing to fix incandescent lights in the existing lanterns throughout the borough for £3 per lamp, all expenses and gas included. Any extra quantity of gas consumed by lamps lighted over 2250 hours in the year to be charged at 3s. 3d. per 1000 cubic feet. Sugg lamps, with duplex incandescent burners, supplied by meter, to be charged 55s. per annum each, and 4s. meter-rent. Several members took part in the discussion, among them being Alderman Adams, who thought the time had come when they should deal with this question of lighting, instead of "tinkering" with it; and it was his opinion that the gas and water supply should be in the hands of the Corporation. Mr. A. B. Capps considered the Council should be no longer subject to a "monopoly;" and he hoped they would proceed with an electric lighting scheme. The Mayor (Mr. A. G. Lucas) wished the Council to ascertain the cost of lighting by electricity before obtaining a Provisional Order. He feared that the initial cost would be considerable, and that it would not be so quickly remunerative as in other places, owing partly to the length of the town. Eventually the matter was referred to the General Purposes Committee and the Sanitary Committee jointly to obtain a tender from the Gas Company for lighting the town without providing any more incandescent lights than those already in existence, and to take into consideration the advisability of lighting the streets by electricity.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bill read a second time and committed: Barry Urban District Council Bill.

Bills reported, with amendments: Bilston Improvement Bill, New River Company Bill.

Bills read the third time and passed: Bournemouth Gas and Water Bill, Edinburgh Extension Bill, Kilmarnock Corporation Water Bill, Water Provisional Orders Bill.

Bills Royal Assented: Brighton Corporation Water Bill, Burton-upon-Trent Corporation Bill, Culter Water Order Confirmation Bill, Dalmeny and Kirkliston Water Provisional Order Bill, East Surrey Water Bill, Gas and Water Provisional Orders Bill, Kelty Water Provisional Order Bill, Kirkcaldy and Dysart Water Bill, Leamington Corporation Bill, Local Government Provisional Orders (Gas) Bill, London Sea Water Supply Bill, Matlock Bath Gas Bill, Newcastle-upon-Tyne and Gateshead Gas Bill, Portsmouth Borough Water Bill, Yeovil Corporation Water Bill.

HOUSE OF COMMONS.

Tuesday, July 21.

THE EAST LONDON WATER SUPPLY.

Mr. H. SAMUEL asked the President of the Local Government Board if he was aware that the East London Water Company had cut off the supply to their customers from nine o'clock in the evening to six in the morning until further notice; and, if so, considering the great inconvenience caused in East London, whether he was prepared to take any steps in the matter.

Mr. CHAPLIN: I am aware that the East London Water Company have given notice that the water supply will be shut off from nine o'clock at night until six o'clock in the morning; and immediately I received that information I requested General Scott, the Official Water Examiner for the Metropolis, to inquire into the facts and report to me the result. I much regret to say that this discontinuance of the supply at night has become necessary as a precautionary measure in consequence of the fact that the works authorized by the Act of 1894 have not yet been fully carried out, and also because of the long-continued drought, which has been far more serious even than in the previous year. I am in communication with the East London Water Company upon the subject; and I hope that the New River Company, with whom I am also in communication, will be able to render some assistance as regards the supply by the East London Company.

Thursday, July 23.

Mr. BOUSFIELD asked the President of the Local Government Board whether he was aware that in some portions of the district served by the East London Water Company there was no water available for flushing closets at 9.30 in the morning on the previous day, and that at the same time water was being freely used for watering the roads; and whether he was in a position to state whether any, and, if so, what, immediate steps could be taken to insure a sufficient water supply to houses in East London for sanitary purposes.

Mr. CHAPLIN: I have learnt with much regret that the East London Water Company have found it necessary to restrict the supply of water to six hours a day, in consequence of the extreme drought; and I have no reason to doubt the statement that in some portions of the district served by the Company there was no water supply available at 9.30 in the morning yesterday. With regard to the statement that water, notwithstanding, was being used for watering the roads, I may say that on Tuesday I communicated with the Company and with the several local authorities within the limits of supply by the Company, stating that the Local Government Board considered that, as far as possible, the supply of water for street watering should be discontinued in the district of the Company so long as the present drought prevailed, and expressing the Board's hope that the local authorities would concur in the adoption of this course. As I previously stated, I communicated with the East London Company and the New River Company, suggesting an arrangement by which assistance as regards the supply of water should be obtained from the latter Company. Negotiations, I understand, are now proceeding; and I am inquiring what has been done in this matter. I am also urging upon the Company the importance of at once fixing standpipes to such of the mains as are constantly charged, with the view of diminishing the serious inconvenience arising from the direct supply to houses being limited to six hours a day. The Company are pressing upon consumers the extreme importance of all waste being avoided, and urging that the use of water for gardens and other similar purposes should be discontinued; and, from the information I have received, I am convinced of the necessity of husbanding the supply as far as possible.

HOUSE OF LORDS COMMITTEE.

Thursday, July 23.

(*Before Lord* BROUGHAM AND VAUX, *Chairman; the Earl of* PORTSMOUTH, *the Marquis of* BRISTOL, *Earl* BATHURST, *and Lord* IVEAGH.)

NEW RIVER BILL.

This Bill, as originally introduced in the Lower House, proposed an expenditure of about £1,500,000 for the sinking of new wells in Hertfordshire, the construction of an extensive storage reservoir at Enfield Chase, together with an aqueduct leading to a new subsiding reservoir, filter-beds and pumping-station at Highfield, and various other new works and improvements of existing works. In the passage of the Bill through the Commons, the Committee of that House (see *ante*, p. 77)

struck out the proposed new wells and some of the other items; but allowed such modified provisions as would enable the Company to increase their storage, and enlarge and improve their existing pumping and other works.

Mr. POPE, in opening the case for the promoters, said the Hertfordshire County Council were the only petitioners against the Bill; but the right of that authority to oppose the Bill at all was somewhat doubtful. Learned Counsel then went on to describe the Bill as left by the Committee of the House of Commons, who had been specially instructed by the House to allow only such further powers to the Water Companies as could not, without detriment to the interests of the public, be postponed. Learned Counsel pointed out that, in the House of Commons quite recently, Mr. Chaplin had referred to the probability of the recurrence of the water famine in the East-end of London, and had said that new works, now nearly completed, would, it was hoped, put an end to this danger. The right hon. gentleman had also said that he looked to the New River Company and the other Water Companies to lend assistance in this emergency. The position of the New River Company was this: They were responsible for the water supply in a part of the Metropolis which required water more than any other section. The Company needed water, not only for their own consumers, but to give assistance to the East London Company in times of emergency caused by drought or otherwise. They must have sufficient to meet the requirements of the consumers during the next four or five years. By the present Bill, the Company were empowered to raise a sufficient amount of capital to enable them, by the improvement of their existing works, to provide the supply that was immediately necessary in the interests of the water consumers. In the House of Commons all additions to existing works in view of the prospective water supply had been eliminated from the Bill. Objection was taken by the Hertfordshire County Council to the Company enlarging their pumping works in that county, for the purpose of drawing more water from the chalk. The Company did not seek to erect new pumping-stations, but simply to enlarge their present works, so as to be enabled to exercise their common law rights to pump water from their own land, for the purpose of carrying out their statutory obligations the more efficiently. It was asserted by the petitioners that wells belonging to private owners had been deprived of their supplies through the operations of the New River Company. This statement was not correct; there was an abundance of water. The real complaint of the petitioners was as to the exercise by the Company of the common law right inherent to every owner of property. He doubted the *locus standi* of the petitioners to go into the common law question before their Lordships. If they had, it would probably lead to a fortnight's inquiry into the amount of water in the chalk, and the effect of the existing pumping operations upon the bulk of water. Before the Commons Committee, the petitioners had had an undoubted *locus standi*, for in the Bill as originally drawn it was proposed to take land in Hertfordshire; but this provision had since been struck out. There was no grievance alleged in the petition entitling the Hertfordshire County Council to be heard; and even if there were, the Clerk had no authority to affix the common seal of the Council to the petition against the Bill. The authority given was in respect of the original Bill, which was a different measure to the present one.

Lord R. CECIL defended the *locus standi* of the County Council. Their seal, he said, had been set against all the provisions of the Bill; and a great number of these provisions still remained. The Council clearly had a right to object to water being taken from below the surface of the land to such an extent as to injure the water-courses of the county.

The CHAIRMAN: Are their pumps on their own land?

Lord R. CECIL: Yes.

The CHAIRMAN: Then they can pump as much as they like.

Lord R. CECIL said, if that were so, there would at once be an end to the whole controversy. If this theory were to prevail, the Council would not be entitled to protect the inhabitants of the county against any underground pumping whatever. As to the question of common law right, his learned friend Mr. Pope had gone astray; and it was necessary to draw attention to the vast difference between a corporation and an individual. They were governed by quite a separate set of laws. According to English common law, an individual could do anything which he was not expressly forbidden to do by the law; but it was not so with a corporation or public company. According to the decision in the House of Lords in the case of the *Ashbury Carriage Company v. Rich*, a corporation could only do that which it was expressly entitled to do. The power which the promoters of the present Bill possessed to pump water was given to them by their Charter and certain Statutes, including the Water-Works Clauses Act. There was a limit to their power to sink wells, because they could only apply to this work the capital which Parliament authorized them to raise for the purpose—that was to say, Parliament kept a check on them by saying: "You shall not have this money unless we know what you are going to do with it." Parliament acted on this doctrine, and only gave what money was necessary. In this very case, in the Commons, only so much capital was allowed as was considered essential in the interest of the public. But, in addition to all this, his learned friend Mr. Pope had exaggerated the rights of an individual to pump water from the sub-soil. The learned gentleman said that a person had a right to pump water from his land so long as he did not take it from a stream; but that was not so. In the case of *Dickinson v. The Grand Junction Canal Company*, it was laid down that an individual had no right to pump water to such an extent as to diminish the flow of a stream, even if the pumping were not directly from the stream itself. It was, he thought, necessary for Parliament to consider his allegation—which he was in a position to support by evidence—that a large number of wells at work in this district seriously diminished the flow of many streams, though it might be impossible to say that a certain well affected the flow of a certain stream. Look at the position of this Company. The Commons Committee proposed to give them £390,000 to do anything they liked with, consistently with the general purposes of the Company—that was subject to their being able to obtain the land. They were to do anything they pretended to have a right to do. They could use the whole of the £390,000 to obtain land, lay down pipes, sink wells, and pump the place dry, as they did now to some extent. Not a penny of the sum was allocated to any particular purpose. The whole thing was covered by clause 36, under which they could do exactly as they wished. He would call their Lordships' attention to the second paragraph in the Instruction to the House of Commons Committee—viz.: "To insert in any Bill authorizing the creation of further capital, provisions which will prohibit the application of such capital to any purpose other than the construction of works or the acquisition of land for which it is authorized by the Bill to be raised; or the expenses of the Bill." The Committee of the Lower House must have thought that they had effectually guarded against a breach of that Instruction; but his learned friend Mr. Pope would not pretend that there was any provision in the Bill allocating the money to the purposes to which it was asserted it would be applied. Whether the wells from which an increased quantity of water was pumped were in Hertfordshire or in Middlesex, was immaterial. The question was whether the Hertfordshire County Council had a right to prevent the Company taking the water supply of their county. If they had no right to object, then they had no *locus standi*.

Mr. POPE denied that he had exaggerated the common law right of an individual to pump water from his land; and he pointed out that the case of *Dickinson v. The Grand Junction Canal Company*, to which the noble lord referred, had been disproved on appeal in the House of Lords. There could be no doubt of the common law right of the proprietor of land to pump water from his land; and he knew of no difference between an individual and a corporation. A corporation was, in law, an individual, and was liable to all the duties and responsibilities, as well as inheriting all the privileges, of an individual. His noble friend was really asking the Committee to uproot the common law of the country. As to the allocation of the capital, the Commons Committee had done what they could to find out what the works were going to be, and how the money was going to be spent. He was sure the Committee would not authorize the Hertfordshire County Council to raise grievances which were not grievances to themselves personally, but merely of a hypothetical character. In the other House, there was an express order that everyone was to be heard by the Committee; but that was not the case in their Lordships' House. Besides, as the Bill went before the Lower House, it proposed the carrying out of new works in Hertfordshire; and as the County Council were the owners of the roads and guardians of streets, they had a right to be heard.

Their Lordships then cleared the room, and remained for some time in private deliberation. On the re-admission of the public,

The CHAIRMAN said the Committee had decided to disallow the *locus standi* of the Hertfordshire County Council.

The Bill was therefore referred to Earl Morley's Committee as an unopposed measure.

Friday, July 24.

STAINES RESERVOIRS BILL.

To-day the Committee considered the clauses of the above-named Bill. Lord de Ros had been nominated to replace the Marquis of Bristol, who had served on the previous day; but his Lordship, not being in attendance, it was decided that, as there was to be no question on the preamble of the Bill, the inquiry might proceed in his absence. The Chairman duly reported the fact to the House.

Mr. POPE explained that the measure was promoted jointly by the New River, the Grand Junction, and West Middlesex Water Companies. As amended by the Hybrid Committee of the House of Commons, it had for its object the formation of two large storage reservoirs near Staines, the construction of an open aqueduct to connect the reservoirs with the works of the respective Companies, and the acquisition of other powers, including one to enable the Joint Board set up by the Bill to borrow the money necessary to put the scheme into effective operation. The learned Counsel declared that the measure was promoted, not so much in the interests of the Companies as in those of the consumers—it was, in fact, a Consumers' Bill. So far as the Companies were concerned, not only would the Bill be no source of profit to them, but it was estimated that its result would be to mulct them in a loss. The proposal in the Bill was really what the Committee of the House of Commons thought was the least they could possibly allow for the purpose of securing that an adequate supply of water should be furnished to the Metropolis during the period which must elapse before any comprehensive scheme could be carried out. All parties had discussed the matter so fully before the Commons Committee that, although they were not of one mind in regard to the principle of the measure, practically they had mutually agreed to accept the decision of the Committee below as a temporary settlement of the question. It would, therefore, be sufficient if he indicated to the Committee in general terms what was really the nature of the Bill. The learned Counsel then went briefly over the various provisions of the measure; pointing out the demands which had originally been made by the three Water Companies, and the various respects in which Sir Joseph Pease's Committee had modified the scheme. He went on to say that the scope and object of the measure was to carry out the recommendations of the Royal Commission on the London Water Supply of 1893; the object of which recommendations was to render, if possible, the supply of water to the Metropolis more reliable than it had been in the past. A few days since, a question had been addressed to the President of the Local Government Board (Mr. Chaplin) in regard to the prospects of the water supply in the East-end of London; and the reply was that it was obviously desirable that, as far as possible, a supply should be held in reserve for emergencies which might at any time arise. At present the East London Water Company were constructing additional works, which, when completed, would go a great way towards placing their supply in comparative safety. But the President of the Local Government Board had also stated that, to meet the immediate necessities of the East London Company, he had entered into negotiations to enable the New River Company to come to the rescue, and furnish a supply of water. This showed the necessity for giving the present promoters a

margin of supply; and in the Bill now before their Lordships, such a margin was provided. With regard to the opposition, he now understood that the only active opponents of the Bill were the London County Council. The petition of the Hertfordshire County Council had not been withdrawn; but this body did not desire to take any part in the discussion of the Bill.

Mr. BALFOUR BROWNE, on behalf of the London County Council, said he did not intend to offer any opposition to the preamble of the Bill. He wished to state the nature of the petition against the scheme, and to criticize the provisions of the Bill itself, so that the attitude of the County Council might be plainly set before their Lordships, and the views of that authority might remain on record for purposes of future reference. The County Council had objected to the scheme on the ground that, by abstracting a large quantity of water from the River Thames, it would decrease the flow of the stream in its passage through London; that they considered other sources of supply to be preferable; on the ground of their desire to prevent waste; because of the absence of provisions as to the supply of compensation water; and so forth. He pointed out that the attitude of the London County Council towards the Bill had completely changed, in consequence of a resolution having been unanimously passed by that body declaring that in the next session of Parliament (1897) a Bill should be promoted by them to obtain powers to purchase all the Metropolitan water undertakings. If the Council secured leave to purchase, they would be in a position to consider whether the powers now asked for should be transferred to them to carry out, or whether they should be abandoned and another source of supply adopted. Even if the Purchase Bill did not receive the sanction of Parliament, there would most probably be one introduced for regulating the Water Companies. Under these circumstances, the position of the Council having thus been changed, little harm would be done to the public interest by allowing the Bill to proceed. The Committee, however, would see from his statement that the measure was by no means free from blemishes. Sir Joseph Pease and the members of the Commons Committee had sought to safeguard the public, by introducing into the Bill clauses to the effect that, if purchase took place, the Companies were not to be dealt with by the purchasing authority as though the passing of this Bill, and the establishment of the works empowered to be constructed under it, had enhanced the selling value of their respective undertakings.

Lord BROUGHAM: They propose to spend £1,000,000. The value would be enhanced to that extent, I presume.

Mr. BALFOUR BROWNE said that the value would be enhanced by £1,000,000, no doubt; but that capital would be provided on mortgage, and no consideration would be allowed in regard to any profits which might accrue from the expenditure of the money. But though the Bill provided that the three Companies were not to have their value enhanced, there was serious doubt in the minds of many people as to whether the Bill might not be made a means of increasing the value of other Companies in London. It was clearly not the intention of the promoters that that should take place; and, therefore, he only asked his old friend to put the Bill right in this respect.

Mr. POPE: We can say nothing on behalf of other Companies; and, moreover, you are going beyond your petition.

Mr. BALFOUR BROWNE remarked that it was not his intention to make this a serious matter of argument; and he should be surprised if the promoters showed an inclination to walk round a Committee of Parliament.

Mr. POPE said they were not anxious to do anything of the kind; but they certainly were not concerned in preserving the dignity of the London County Council.

Mr. BALFOUR BROWNE said he did not believe that the promoters intended for an instant that the Bill should have the effect of enhancing the value of other Water Companies. Still there was some doubt as to whether it would not have that effect. The measure might enable the three Companies to supply water to other Companies, and so might give other authorities a claim in respect of benefits derived by them in this way. The advisers of some of the Companies did not think there was any danger of this; but he only asked his learned friend to adopt a clause declaring what their intentions were. If the proposal was resisted, he must be content to take their statement that it could not be argued that the Bill would enhance the value of other Companies. To his mind there was a serious doubt, which ought to be set at rest.

Mr. POPE replied that he saw no doubt; and as the proposal affected interests which he did not represent, and inasmuch as there was no mention of the matter in the petition, he must decline to consider it.

Mr. BALFOUR BROWNE pointed out that it was paragraph 20 of the petition which referred to the effect of the Bill.

Mr. POPE said the effect of consenting to an alteration of the clauses would be to send the Bill back to the House of Commons; and looking at the period of the session at which they had now arrived, that might be fatal to the Bill. To his mind, the point raised was provided for in the Bill; and they ought not to go into the matter any further.

Mr. BALFOUR BROWNE said that, as the promoters considered the Bill would be injuriously affected by adopting his proposal, he would go no farther; but he reserved to himself the right to take action in the future, and make good his criticisms.

Formal evidence having been given,

The CHAIRMAN declared the preamble of the Bill proved.

The clauses were then gone through; and the Bill was ordered to be reported.

Yeovil Gas Company, Limited.—The report presented at the annual general meeting of this Company yesterday showed that the profit on the working in the twelve months ending June 30 last amounted, with the balance brought forward, to £2550. An interim dividend of 5 per cent. was paid in February last; and the Directors recommended a further payment of like amount, free of income-tax. There was an increase of 1,400,000 cubic feet, or about 4¼ per cent. in the make of gas in the year. This was largely due to the increasing demand for cooking and heating purposes; the Company having now about 200 stoves on hire. A reduction in price was announced in the report last year; and the augmented sale of gas indicates that this has not been prejudicial to the Company's interests.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Saturday, July 25.

(*Before Mr. Justice* KEKEWICH.)

In re the Colombo Gas and Water Company, Limited—Electric Lighting Powers Sought.

This was a petition asking the Court to confirm a special resolution which had been duly passed by the Company with the object of enlarging the scope of their operations, as defined in the Memorandum of Association; in particular, giving them power to supply electricity for lighting purposes.

Mr. HENDERSON appeared in support of the petition; and, there being no opposition, he was not even called upon to read it.

Justice KEKEWICH said he had read it, and no doubt the Company were well advised in presenting it. It was probably necessary to have further powers for supplying electricity; but on some points he thought the Company already had larger powers than they thought.

Mr. HENDERSON, in reply to a question by his Lordship, said the petition was verified by an affidavit of the Chairman of the Company, who said that, if the alteration were confirmed, the Company would be able to carry on their business more efficiently and economically; that the consumption of gas would be encouraged and promoted; and that the profits would be increased without any corresponding increase in the capital expenditure on new works or machinery.

Justice KEKEWICH said, of course, the petition would not have been presented if the Chairman did not believe that. The only question was whether anyone objected.

Mr. HENDERSON said no one objected; and they had the actual consent of the holders of £18,000 out of the £28,000 of debentures.

Justice KEKEWICH then made the order as asked, and said it was not necessary to change the name of the Company. Nobody could be misled by a gas company supplying electricity.

Thefts from Prepayment Gas-Meters.

A few weeks ago, two men, named Reid and Merridew, were committed for trial on a charge of feloniously entering certain premises upon which automatic prepayment gas-meters, the property of The Gaslight and Coke Company, were found to have been tampered with. Last week, at the Central Criminal Court, they were sentenced to eighteen and twelve months' imprisonment respectively.

The Supply of Water during the Frost of 1895.

In the Queen's Bench Division of the High Court of Justice, on Monday last week, an action brought by the Barnes District Council against the Southwark and Vauxhall Water Company, to recover the balance of an amount alleged to be due from the Company under an agreement entered into at the time of the great frost in 1895, was heard by Mr. Justice Lawrance and a special jury. In February and March, 1895, the defendants' mains in the neighbourhood of Barnes were frozen; and it became necessary that the plaintiffs, as the Sanitary Authority, should take steps to see that householders were supplied with water. They accordingly put themselves into communication with the defendants; the result being that it was arranged that the neighbourhood should be supplied with water by means of carts. The point in dispute was as to the precise terms of this arrangement. It was stated, on plaintiffs' behalf, that the defendants undertook to bear the whole of the cost. For the defendants, it was urged that the arrangement was that each party should bear one-half the cost; and evidence to this effect was given by the Deputy-Engineer and an inspector. The sum of £142 had been paid on account. In the result, the jury found for the plaintiffs; and judgment was entered in their favour for £183 10s. 10d., with costs.

The Recent Fatal Accident at the Huddersfield Gas-Works—A Question as to Compensation.

At the Huddersfield County Court last Thursday, his Honour Judge Cadman and a jury had before them an action, brought, under the Employers' Liability Act, against the Huddersfield Corporation by Harriett Frith, of 72A, Northumberland Street, Huddersfield, as administratrix of Thomas Frith, who died on June 17 from injuries received while employed at the Corporation gas-works on the 13th of that month, through an explosion arising from the defective condition of the brickwork of a furnace. The plaintiff, for whom Mr. T. D. Ruddock appeared, claimed £281 18s. 5d. The Deputy Town Clerk (Mr. J. H. Field), on behalf of the Corporation, stated that they considered that, whatever might be their position in law, the case upon the facts was eminently one for compensation. They had, therefore, unhesitatingly resolved to pay the utmost farthing allowed by the Act. It was, however, necessary, under the Act, for the verdict of the jury to be taken in order to apportion the damages between the widow and children of the deceased; and therefore this friendly action had been brought. His Honour said that the Corporation had come forward very handsomely in the matter; and, by his direction, the jury gave a verdict for the plaintiff for £281 18s. 5d.—£150 for the widow and £21 19s. 7d. for each of the six children, in accordance with the terms arranged.

The Brentford Gas Company's Dividend.—The Directors of the Brentford Gas Company will, at the next meeting of the shareholders, recommend the payment of dividends for the past half year at the rates of 5, 12, and 9 per cent. per annum.

MISCELLANEOUS NEWS.

BRITISH INSTITUTE OF PUBLIC HEALTH.

Professor Ramsay on Smoke Prevention.

The Congress of the above-named Institute was opened in Glasgow University last Thursday, under the presidency of the LORD PROVOST (the Right Hon. Sir J. Bell). In his address, his Lordship dealt chiefly with the sanitary history of Glasgow; closing it with a few remarks testifying to the value of the meetings of the Institute. Subsequently, Professor W. RAMSAY, of University College, London, delivered an address as President of the Chemistry and Engineering Section, in the course of which he spoke as follows on the subject of the smoke nuisance and its prevention:—

The smoke nuisance is indeed one of the most pressing problems of our age—an age when human beings, owing to the economic conditions of our manufactures, flock into towns, and render their size stupendous. For many years we have been endeavouring to overcome the inconveniences—and, worse than inconveniences, dangers—brought about by this centralization. The disposal of our refuse, the supply of our water, the precautions to secure a reasonable cleanliness—all these have been carefully considered; and difficulties have in a great measure, and here in Glasgow especially, been overcome. But we have not yet touched the fringe of that great pall which hangs over our cities, shutting out the sunlight, and which, while it is an enemy to cleanliness, is also a supporter of disease. We can classify, as is usual, under three heads, the harm done to us by smoke: (1) It deposits in our houses, on our clothes, and on our persons, as "blacks;" necessitating a great expenditure of labour and of soap. (2) It condenses atmospheric vapour—causing fog and rain, and rendering our climate colder; and it makes our lives more or less unhappy and uncomfortable. (3) It shuts out sunlight, and thus increases the growth and tends towards the multiplication of bacteria, many of which are of a dangerous character; and, inasmuch as it condenses vapour on its particles, it accumulates in the atmosphere, in the form of haze, mist, or fog, material capable of absorbing precisely that quality of light which proves fatal to bacteria—viz., blue, violet, and ultra-violet light. I imagine that everyone present will agree with me in thinking that, if smoke could be reduced in our cities, we should lead happier lives; for there is a mental aspect to the question. Bright and cheerful weather promotes bright and cheerful dispositions. I fancy, however, that few among my audience are aware of the heavy charge here preferred against the continuance of the smoke nuisance—namely, that it directly incites disease. Legislation has to some extent stepped in and forbidden the emission of excessive amounts of smoke or fume from the chimneys of factories and works, and even from domestic houses. To have a chimney on fire can be punished by a fine. But it may be said that much is nowadays done to promote the smokeless burning of coal in our factories by mechanical stokers, or by regular firing, or, when possible, by burning a fuel which emits little smoke. I am afraid that little inducement can be held out to the manufacturer in endeavouring to persuade him that a saving can be effected by burning fuel without smoke; and in legislating against smoke, the inducement of a direct saving in heat cannot be offered. Restrictive legislation must have another basis—the commonweal; the damage inflicted on the convenience and health of the public. I shall therefore attempt, bold though the attempt may be, to indicate what lines our endeavours should follow.

There is one material—viz., coke—which gives out, weight for weight, a greater amount of heat than coal, which emits no smoke, and which produces what all of us are so unwilling to relinquish, a bright glow in the grate. In Paris it is the universal fuel; but it is there burned in stoves, where the glow can be seen only through windows of mica; and though heat radiates through mica much more readily than through glass, yet the heat is produced mostly by the heating of the air of the room owing to contact with the hot iron of the stove. Such a stove requires replenishing only once a day. The luxury of poking the fire is unattainable; but, by moving backwards and forwards a bar at the front of the stove, the ashes fall through into the ash chamber, and the coke burns with a brighter glow. Such a stove keeps alight day and night for six months, if need be, giving very little trouble, and a great deal of heat. Much as I should like to see such stoves introduced in Scotland, with their cleanliness, freedom from ash, and efficiency, I am not sanguine enough to expect that any attempt to bring them in wholesale would meet with the smallest success. And I therefore venture to propose what may be a less efficient plan, but one certainly more likely to recommend itself to most householders. The Glasgow public, if I mistake not, are blessed with very cheap gas. To produce this gas, it is necessary to make at the same time an enormous amount of coke. The gas is necessary for illumination. It is unlikely that the electric light will replace it in the vast majority of our houses, although, doubtless, it will slowly gain a footing. Besides, gas is required more and more for gas-engines. It is usually difficult to dispose of the coke, which is necessarily an accompaniment of the gas, for coke is very troublesome to light. At first it refuses to burn; and it is generally thought to be impossible to light it without a previous coal-fire. Hence it is customary to mix coal and coke where coke is burnt at all. But coke is easily set on fire by a proper arrangement of gas-jets. A grate may be furnished with a gas-bracket, on turning which round at right angles, the flame will play under the bars, and soon kindle the coke; and when coke is once well kindled, it will continue to burn. The gas may then be extinguished, and the pipe bent so as to remove the kindler from under the grate. It then stands out on the hearthstone; and it is easy so to arrange it that it serves as a stand for a kettle or pot. In summer, when a fire is not wanted, a gas-burner is at hand, which may be used for boiling water or cooking on a small scale; and in winter the gas may be used solely to light the fire, or if desired for cooking in an emergency.

Could we induce our dense population to adopt coke fires, our smoke nuisance would be greatly abated. Paris is a larger city than Glasgow, and yet it is clean and bright, while Glasgow is dark and dirty. The difference is almost entirely due to the fuel burned. Were we in the North to adopt the French plan of burning coke, we, like them, would soon inhabit a bright, clean town. I have suggested the only plan, so far as I can see, which will lead us to that result without trampling more than need be on these very sensitive excrescences, the corns of sentiment. But I am afraid that good advice, if not harrowed by paternal legislation, will bear but a poor crop. And the question is: How can legislation be brought so to bear as to produce the required result? I believe that the Corporation already possess powers to check the emission of unreasonable quantities of smoke from any chimney—domestic or factory. Their power, therefore, would turn merely on the reading of the word "unreasonable." If they agree that all smoke is unreasonable, their powers are sufficient. It would manifestly be absurd to construe that reading too literally or too abruptly. But if it were made evident that even a moderate amount of domestic smoke is viewed with a critical eye; if the police were instructed to warn such households that a small fine would be inflicted on householders or lodgers emitting more than a minimum amount of smoke on a second or third offence; and if, simultaneously, the agents of the Corporation Gas Committee were to advertise their wares, to show how easily the necessary gas-fittings could be introduced, and with what advantages to comfort and cleanliness, I think we might trust the public to take the line of least resistance. The process would, doubtless, be a gradual one; for domestic revolutions are never rapidly effected. But, in course of time, public sanction would replace the public resistance which we may expect at first; and as a larger number of people found their advantage in burning coke instead of coal, it would be more and more easy to compel recalcitrant conservatives to act for the public good.

In this address I have endeavoured to state the most important reasons which should induce us to attempt to purify our atmosphere, as we have purified our water supply, and as we are purifying our sewage. The danger from impure sources of the former, and from careless treatment of the latter, have long been acknowledged; but till recently proofs were wanting that a smoky atmosphere is more than an inconvenience. It has been shown to be a positive danger to health; and we cannot disregard the warning. It is now more than ever incumbent on us to devote our best energies to remove this reproach—that, though we are the second city of the empire, we are one of the smokiest. It may be that smoke gained us our high position in the struggle for population and wealth; it is very certain that it is not essential to the continuance of our industrial success.

THE ENRICHMENT OF COAL GAS.

We have received a copy of a circular issued by the Gas Enrichment and Solar Oil Company, Limited, which has been established to acquire the patents of Dr. Dvorkovitz for the production of oil gas and other enriching products, as well as carburetted water gas. In setting forth the advantages claimed for his system as compared with others which have been established in the United Kingdom, the circular, which is signed by the Secretary of the Company (Mr. J. H. Drysdale), states as follows: "The latter are simply plants capable of manufacturing carburetted water gas, and, to be at all successfully worked, require a petroleum oil of a special description, which can only be manufactured by one or two refiners in Russia, and which can only be obtained in a limited quantity, and at a considerable cost—that is, the users of these plants are practically placed at the mercy of one or two refiners in Russia, so far as the supply and price of the oil is concerned. It was in view of this difficulty that Dr. Dvorkovitz undertook the construction of his present apparatus, which has for its object, in the first place, the capability of utilizing any class of petroleum oil—whether crude oil, refined oil, distillates, residuum—so that the gas manufacturer shall have the advantage of an unlimited supply of the cheapest material, and free competition between the various suppliers. This is absolutely essential to the gas companies of England for the safe conduct of the utilization of petroleum oil for gas-making or gas-enriching purposes. With regard to the results obtained by Dr. Dvorkovitz as compared with those obtained by the other processes, even supposing in the latter case the best results ever obtained are taken, the advantage of Dr. Dvorkovitz's process at once becomes apparent. If we take the results of the working of the enormous plant constructed by Humphreys and Glasgow at Beckton, we find the best possible results ever obtained, or reputed to have been obtained, is an equivalent enriching power of about 6¼ to 6½ candles per gallon of oil used, with a residuum which is a mixture of water and tar, and which is not only unmarketable, but almost unsuitable even as fuel. On the other hand, after a continuous working of 33 days of Dr. Dvorkovitz's process, during which 41,125,000 feet of coal gas were enriched, the result proved that the illuminating power derived from one gallon of the same oil was equal to 11½ candles, as compared with 6¼ to 6½ candles obtained at Beckton. But this is not the only advantage, because the residuum left from Dr. Dvorkovitz's process is a pure pitch, without any water whatever, and that can be either sold on the market, or at any rate would make an excellent fuel for furnace purposes. The third advantage possessed by Dr. Dvorkovitz's process is that the manufacture of the oil gas and the other enriching products being altogether separate from the manufacture of water gas, the apparatus can be used either for enriching coal gas separately or for enriching water gas by any candles that may be required; whereas with the carburetted water gas plants now in use, the enrichment of the water gas can only be carried out with the result above described, if the gas be made of no greater power than 21 candles, otherwise the gasification of the oil is not complete, and there is a deposit of vapour in the pipes, and naturally an increase of the proportion of the oil used to the illuminating power obtained. The results above described as having been obtained by Dr. Dvorkovitz's process were results obtained in the almost unprecedentedly cold winter weather of February, 1895. These results were arrived at by taking the average of 420 tests made during 33 days' working; and the gas was in addition tested after having travelled 1¾ miles from the works, where it was found to have suffered no loss of illuminating power. Such a severe

test has never been applied to any other oil-gas process. My Company are now prepared to enter into a contract to construct a plant at their own risk and expense, subject to the above results being obtained (except that the guarantee of candles per gallon shall be limited to a minimum of 10½ instead of 11½ candles per gallon); and if such results are not obtained, then they will undertake to remove the plant, also at their own risk and expense. The plant constructed can either be solely for the purpose of enriching coal gas, or it can be for enriching water-gas, and manufacturing what is called carburetted water gas. The plant is also easily adaptable at very slight cost to the existing carburetted water-gas plants, the output of which could be at the same time very largely increased. In all cases the guaranteed results will be the same."

With reference to the above circular, Messrs. Humphreys and Glasgow write that, in so far as it contains specific mention of their name and work, "the statements are unreliable, and argue an utter want of knowledge of the industry the said Company is ostensibly formed to advance." With regard to the remaining statements, they say the files of the "JOURNAL," reporting the protracted oil-gas controversy at Bradford, may be consulted with advantage.

ELECTRIC LIGHTING NOTES.

Illustrations of the capriciousness of the electric light at inconvenient seasons have appeared from time to time in these "Notes;" and now another is supplied from Cardiff. It happened on the occasion of the recent royal visit to the borough. Whether it was due to the presence of royalty in the town is not known, but anyway the engines at the Corporation electric lighting station warmed up to their work to such an extent that at 10 p.m. the big end of the intermediate rod of No. 2 engine had become heated; and, as it could not be kept under, the engine was shut down, and its load put on No. 1 engine. This addition to its work was more than No. 1 could stand; and after a short time it also warmed up, and had to be shut down to ease the bolts on one rod, thereby causing a total extinction of the light. In order to ensure against a repetition of such a mishap, preventatives in the way of anti-friction linings and a water service to each rod are to be adopted.

At the last meeting of the Yarmouth Town Council, the Electric Lighting Committee reported that the expenditure for June had been £123, whereas the income from all sources was £112—showing a difference of £11. In addition to this, there was about £100 for interest, repayment of capital, &c.; the actual deficit thus being £111. The Borough Surveyor, in his half-yearly report, submitted that the steadily-increasing demand for electric light would soon convert the loss into a gain. The difference between income and expenditure for 1895 was £766, £420 of which was provided for the sinking fund. This was 75 per cent. below the estimated loss. The income for the present year to date was £1082, and the expenditure £817—leaving £265 for sinking fund, &c.; and as this was estimated at £600, there was a net loss on the six months of £335. The interest charges would be increased this half year, and would probably amount to £800; but it was hoped this would be met by a larger income. The money earned in the first half of 1895 was £570, and in the latter half £1370; while that for the six months just ended was £530 more than in the corresponding period last year—the working expenses being only £155 in advance, largely due to the continuous running of the plant through the day. The Surveyor estimated that the loss for the whole of the present year would not exceed £400, and as 10,000 lights would be installed by that time, it might be anticipated that in 1897 there would be no loss to fall upon the rates. Mr. Preece, who was present when the report was presented, stated that, after fully considering the financial position of the works, he thought there was no cause for alarm as to the ultimate success of the undertaking from the fact that during the summer months no profit was being made. He advised that, wherever it could be done, encouragement should be given to customers to extend the hours during which the current was in use, and that special facilities should be afforded for the use of motors during the hours of daylight. The average earning per lamp wired up last year was 7s. 4d. As 9s. was the average earning of its equivalent in gas, it must be expected that this would be increased, and that the cost of working last year, which was 3·17d. per unit generated, would most certainly be reduced; and he hoped during the present year to see it brought down to 2½d. per unit. The public lighting last year had not been remunerative; but he hoped as working expenses were lowered, to see this pay its way at the prices now charged.

For their electric lighting works, the Coventry Corporation originally borrowed £20,000; and this amount has been overspent to the extent of £3189. To meet the excess, and to carry out extensions, they have had to apply to the Local Government Board for a further loan of £3,000. Last Tuesday, Mr. G. W. Willcocks attended at St. Mary's Hall to receive evidence as to the proposals of the Corporation. The works were favourably opened on January 1 last, with about 1800 8-candle power lamps; and at the present time, the number of lights connected, together with applications received, is 3995. The amount proposed to be laid out on extensions is £9810; and this, it is expected, will more than double the capacity of the plant, as the buildings and distributing mains are far in advance, in point of capacity, of the generating plant. It is believed that when the enlargements of the plant have been made, there will be a better chance of commercial success.

The death of John Jackson Chisholme, an assistant foreman at the City Station, City of London Electric Lighting Company, on the 16th inst., was the subject of an inquiry by Mr. A. C. Langham on Monday last week, when Major Cardew, R.E., and Mr. Cameron were in attendance as representatives of the Home Office. Deceased was assisting the chief tester (Mr. Parry) at the works in carrying out a test to ascertain the condition of a main connected with the St. James's Square Station before making it "alive." He had taken the inner cable out of its terminals once without any accident; and he was repeating the operation when he received a shock which killed him. These facts were put before the Coroner by Mr. Parry, who further stated that when Chisholme took out the conductor on the second occasion he remarked that he saw a spark on the terminals. He was not wearing gloves, though these were provided; but he was standing on a rubber mat. If deceased touched the "live" terminal, it would mean a shock of 2000 volts. A juror remarked that this was the sixth accident of the kind in eighteen months, and that the matter ought to be investigated. The workmen stood at Death's elbow all day. Horace Howe, the assistant tester, said he was present when the accident occurred. He gave it as his opinion that the deceased fell, and, to save himself, placed one hand on the wall and the other on the inner terminal. He might have fainted or have been reaching for his gloves, which were just above him. Mr. F. Bolton Aspinal, the Superintendent of the works, said he could only account for the fatality by the supposition that Chisholme touched the terminal, and received a shock through not wearing gloves. Witness produced a set of rules, which said: "No high-tension switches, fuses, or cable ends in the transformer station are to be touched or interfered with in any way while they are 'alive.'" This was signed by the deceased as well as by the other workmen. Witness considered that a shock of 900 volts was sufficient to cause death. Dr. F. Clark, of Crosby Square, said there was only one external wound between the thumb and forefinger on the right hand, about the size of a sixpence. That death was due to an electric shock was characteristically demonstrated by the fact that the blood about the body (instead of being congealed) was absolutely red, fluid, and had undergone no change whatever. The Coroner having summed up, the jury returned a verdict of "Accidental death;" adding a rider, however, that the notice as to wearing gloves should be more extensively distributed at the works. One juror thought a more serious view of the case ought to be taken. Subsequently, the uncle of the deceased made a statement, confirmed by Mrs. Chisholme, which seemed to impute carelessness to an attendant at the St. James's Square station; and the jury withdrew their verdict, and adjourned the inquiry to allow of his being present. The proceedings were resumed last Thursday, when the person referred to—James Robert Tillbrook—was in attendance. He described himself as a "transformer." He said he visited the St. James's Square station (of which he alone held the keys) on six occasions on the day of the accident; but he positively declared that he never did anything to make any of the mains "alive." He was 21 years of age, and had been in the Company's service three years—his wages being 30s. per week. Mr. Bolton Aspinal, the Superintendent of the Company, said the deceased man's wages were 32s. per week. A juror asked if he would have to be a practical engineer for those wages; Mr. Aspinal replied: "A thoroughly experienced practical man." The juror said it seemed to him to be starvation wages. (This remark was acquiesced in by the other jurors.) How, he asked, could the Company expect to get competent men at that rate of pay. Mr. Aspinal admitted that the insurance companies would not accept employees in the Company's service except at the hazardous rate of premium. Eventually the jury returned a verdict of "Accidental death," and added the following rider: "We think the City of London Electric Lighting Company have not taken proper precautions to prevent their employees meeting with accidents of this character. We also wish to express our opinion that the men are not properly paid; and also that notices as to the dangerous nature of the work should be posted at every station."

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Chairman's Annual Address—The Proposed Acquisition of the Water-Works.

At the Meeting of the London County Council last Tuesday, the subject of the water supply of the Metropolis and the position of the Council in regard thereto was a prominent feature of the proceedings. On that occasion, the CHAIRMAN (Sir A. Arnold) delivered his annual address on the work of the Council during the past year; and, in the course thereof, he made the following remarks on the progress of the water question:—

The chief concern of the Parliamentary Committee has been the water question. On Dec. 19, 1895, in a letter addressed to the Chairman of the Council, the Prime Minister made the first announcement of the intention of the Government to introduce a Bill. At that time my connection with the matter was rather intimate. With the Ministers who prepared and promoted the Water Trust Bill I have had long acquaintance; and now to that advantage I have added the honour of personal relations with the Chairmen of the Water Companies. During the year, I have engaged in friendly conference with each and all of these gentlemen; and I am sure that substantial progress has been made towards a settlement of this question. Financially, the delay of sixteen years does not appear to have been wholly injurious, because the credit of the government of London has, since the Government Water Bill of 1880, advanced so far beyond that of the Water Companies. The Imperial Government, which accepted unity of local government as a desirable principle in the Education Bill, reverses this policy in regard to London water; and the reason given by Ministers for refusing the demand that the Water Authority should not be more detached from the Council than a Statutory Committee, is that the Council would have the power of over-ruling the decisions of that Committee, without reference to the opinions of those who represent the outside areas.

Speaking only for myself, I should be willing to accept some compromise, perhaps by giving to the representatives of outside areas place in the Council when matters concerning the water supply were under consideration, or by protecting the Statutory Committee against undue interference in the same way that the new Education Authority was to be protected. But I am convinced that the interest of economy and efficiency alike require that the body which is, and should remain, the sole issuer of Metropolitan Stock is the body in whose name and with whose authority the acquisition of the Water Companies can be most advantageously dealt with. I believe that the practical ability

of the Directors of the Companies would prevent their pressing any such impossible demand as that purchase should be based upon perpetual annuities representing income without any power of redemption, and will lead them to avoid placing their shareholders in a position in which they would appear to be denying to the ratepayers of London the advantage due to their superior credit. The purchase of the business of the Water Companies is a matter of policy less doubtful than before, now that the introduction of an auxiliary supply has attracted the favour not only of Londoners, who see the impossibility of preventing increasing pollution in the valleys of the Thames and Lea, but also of the home counties, whose natural fears are aroused and excited at the prospect of being injuriously drained by wells for the gigantic needs of the Metropolis. I discovered there was great advantage in discussing the subject of purchase with each of the Chairmen of the Water Companies. I found these gentlemen mindful of the difficulties and obligations of their position. The Companies hang together, fearful of what might happen if they were dealt with separately. But there are differences of condition and of value; and, of course, when they are approached collectively, there is a tendency to make the worst condition the measure of demand. It was clear to me, in the negotiations with the Government, that Mr. Chaplin had obtained the collective sentiments rather than the individual opinions of the Chairmen of the Water Companies; but it was not less clear that the Government were accurately acquainted with the strength of the water interest in Parliament, which for practical progress must be taken into account. Some of those who opposed the Government Bill may hold themselves justified by the amendments which Lord James introduced. The Bill, which was originally designed for the constitution of one body, in perpetual separation from this Council and from all of the Metropolitan counties, except those parts within the Metropolitan water area, was transformed into a fissiparous measure, enabling and encouraging the county contingents of the Water Board to separate and to maintain such an independent existence as the Council might have sought for them had the matter been left to our initiative. The Government Bill in amended form offered, it may be said, a cumbersome, complicated, and costly method for arriving at the position to which the aims of the majority of this Council have been directed.

The net result of recent proceedings has been to show that with increasing population, and therefore pollution in the valleys of the Thames and Lea, and with increasing demand for water due not only to the larger population but to a rising standard of comfort, dependence solely upon those valleys for water supply is not justifiable; and the suggestion for resort to the high land of Wales, which has not only commanding elevation, but also a rainfall more than three times as great as that which descends in this watershed, has derived added strength from the fear of the home counties outside the Metropolitan area that they will suffer in their health, their agriculture, and their manufactures, if they are drained exhaustively. This condition renders the policy of purchase more imperative, because it may be found that Parliament would not consent to the introduction of water from afar until the Water Authority so acting was in possession of the business of the existing Companies. The question is: How is this purchase to be accomplished? If the Government Bill were re-introduced, the Water Board might possibly in the space of five years be dissolved into several atoms; and the final operation might be the destruction of the common seal and the merging of the great remnant into this Council. That is a roundabout method. The progress of the Water Companies' Bills in the present session of Parliament has made less difficult a separation of our own county interest from that of our neighbours; and I trust that during the recess we may be able to arrange with the Government for a better conclusion. My negotiations lead me to a confident opinion that, if we were given by Parliament powers of purchase with an arbitration clause, which I think might be agreed upon without serious difficulty, we could make voluntary agreements for purchase of a satisfactory character with the majority of the Companies. I believe that those who are willing to treat would be desirous of leaving with us the question of dealing with the outside areas; and it seems to me that the authority of the Government could be most usefully exercised in providing that we should not enter into possession of the business of the Companies until equitable arrangements had been made for the outside areas. The result, whether the Government proceed by way of the Water Board, or favour a proceeding by our own Bills, may possibly at the expiration of five years be the same. This Council will be, as it should be, the Water Authority for London. But I feel no doubt that while the advantage to the Water Companies would be the same in either case, the cost to the ratepayers in all the Metropolitan counties will be much less if the latter procedure be adopted.

The best work of the Water Committee has been in preparing the way for the introduction of an auxiliary supply by the Water Authority for the Metropolitan area. This Committee obtained the assent of the Council to the following propositions: (1) That it is in the interests of London that the requisite augmentation to its supplies of water should be derived from some source other than the Rivers Thames and Lea; (2) that the valleys of the Usk, the Wye, and the Towy, with their tributaries, furnish the most suitable area from whence such supply shall be derived; (3) that the Usk and Llangorse section of the Welsh scheme should be undertaken in the first instance. I am glad the Council agreed to the completion of the preparatory design for this scheme, because it will be a possession of value to any who may be responsible for the water supply of London.

Subsequently the debate was resumed on the following recommendations of the Water Committee: (*a*) "That the Council do apply to Parliament in the ensuing session for power to bring additional supplies of water to London from the watersheds of the Usk and Llangorse, upon the lines of the report of the Water Committee, as approved by the Council on April 21, 1896." (*b*) "That a Bill or Bills be prepared for introduction in the session of 1897 for the purchase of the undertakings of the eight Metropolitan Water Companies." (*c*) "That it be referred to the Parliamentary Committee, in conjunction with the Water Committee, to prepare and submit to the Council the necessary Bills for carrying out the foregoing resolutions."

Mr. M'KINNON WOOD moved that, in view of the fact that Sir Benjamin Baker and Mr. G. F. Deacon were considering, and would report upon, the whole question of the extension of the water supply of London, recommendation (*a*) should be adjourned until after the recess.

This was agreed to.

Lord ONSLOW protested against the expenditure of the rates upon the promotion of further Bills, which in their nature and character could, he said, have little or no chance of passing. The time had arrived when they ought to deal with this question, not in a number of Bills, but in one large and comprehensive measure which would embrace the whole subject. He was no champion of the Water Companies; but it was not dignified that a great body like the London County Council should from session to session continually bring in measures dealing with each of the Companies separately. He moved a preamble to recommendation (*b*) which would make it read as follows: "In view of the desirability that the authority or authorities which may be entrusted by Parliament with the administration of the London Water Supply should be in the position to undertake the purchase of the Water Companies interested with as little delay as possible, the Council, without in any way committing itself at this stage to the terms of purchase and forms and other provisions of the Bill, do hereby resolve that a Bill be prepared for introduction into Parliament in the session of 1897 for the purchase of the undertakings of the eight Metropolitan Water Companies."

Mr. H. P. HARRIS seconded the amendment.

Mr. W. H. DICKINSON, the Chairman of the Water Committee, said that while he was perfectly willing to accept the preamble to the recommendation, he could not agree to the suggested substitution of the word "Bill."

Lord ONSLOW said he was agreeable that the words "a Bill or Bills" should stand for "Bill" in his amendment.

Mr. B. L. COHEN, M.P., objected to the motion, because it was an exact reversal of the previous policy.

Mr. J. STUART, M.P., thought the Council would do well to accept the preamble. It was practically what they had agreed upon in an earlier part of the year; and it left the hands of both parties untied.

Mr. C. A. WHITMORE, M.P., said that, whatever the noble earl might propose on behalf of the Moderate party, there was a minority—perhaps only a small one—which was absolutely opposed to purchase.

Mr. E. HUBBARD opposed the introduction of the Bills, since the Moderate party had agreed to leave the matter in the hands of the Government, and because the introduction of the Bills would mean expense to the ratepayers.

Sir JOHN LUBBOCK supported the view advocated by Mr. Cohen and Mr. Whitmore—that control would be preferable to purchase in the interests of the ratepayers. The control exercised by Government Directors on the Indian railways was a system which worked well, and combined the advantages of individual enterprise with Government supervision. He felt satisfied that something similar would be the best in reference to the London Water Supply, and that purchase of the Companies' undertakings would add to, and not diminish, the cost of water to the London ratepayers.

Mr. HARRIS said the amendment was practically the outcome of a resolution which had been passed unanimously some time ago. It was necessary that the question of purchase should be brought before Parliament, and be decided one way or another.

The recommendation of the Committee, with the preamble, was then agreed to.

Mr. M'KINNON WOOD moved the omission of the words "in conjunction with the Water Committee" in recommendation (*c*); and it was agreed to. It was also decided to insert the words "Bill or" before the word Bills.

The Council then passed to other business.

THE DRY WEATHER AND THE WATER SUPPLY.

The long-continued spell of dry weather through which we are now passing—a condition of things unprecedented for something like eighty years—is necessarily causing considerable uneasiness to those who are responsible for keeping up the supply of water. In London, as will be seen from the questions put to the President of the Local Government Board last week, as given in our "Parliamentary Intelligence," the pinch is felt in the district of the East London Water Company; and this matter had the special attention of the Directors at their meeting last Thursday. Already it has been necessary to curtail the supply; and they came to the conclusion that, unless the consumers exercised greater care in the use of the water, a still further restriction would have to be placed upon the six hours' service now in operation. The Secretary of the Company (Mr. I. A. Crookenden) points out that no alteration in the continuous service would have been rendered necessary had not the London County Council obstructed the Company's Bill in 1893, which provided for the construction of additional works. Immediately the Bill passed in 1894, however, the Company pushed on with the works; and up to about a week ago they had been able to furnish an unrestricted supply of water. Owing, however, to the improvident use and the "criminal" waste of water, the Directors had felt themselves compelled to reduce the service to six hours a day, and to issue notice to the local authorities within the East London area prohibiting them from using the Company's water for street sprinkling purposes. Last Friday, the officials of the Company erected stand-pipes in various parts of their area, for the convenience of consumers in crowded working-class districts. Prior to the request of the President of the Local Government Board, the Company had found it necessary to supplement the six hours' service by providing stand-pipes at central points. From the official returns issued by the Company's Engineer (Mr. W. B. Bryan, M.Inst.C.E.), less water was lost on Thursday than was the case on any previous day during the week. As the result of negotiations with the New River Company by the President of the Local Government Board and the Directors of the East London Water Company, it has been found impossible to

augment the service of the latter Company. The Directors, however, are, it is understood, in a position to supply their consumers for some time to come at the rate of 25 gallons per head per day. It is stated that, though the drought has been more severe than last year, the Company had, on the 1st inst., 400 million gallons more water in stock than at the corresponding date in 1895. In the outskirts, the daily supply of water has lately been limited to two hours in New Barnet, Finchley, and the neighbouring districts; and a further curtailment has now become necessary owing to the present remarkable season following several dry summers. The Barnet Company are doing their utmost to keep up the supply; but the Secretary (Mr. Alfred Lass) plainly told a newspaper "interviewer" that "if the present road and garden waste continues," without a prompt succession of rainstorms, there will be a painful scarcity.

In the Provinces, Leicester is again suffering from a very grave condition of affairs. The Corporation have been compelled to cut off the water from six at night to six in the morning. But even this has failed to effect sufficient saving; and they announce that, unless further auxiliary supplies are discovered, the supply will be reduced to seven or eight hours per day. The reservoir at Bradgate is upwards of 19 feet below the level, and is practically empty. A new reservoir is almost completed, and will be opened in September; but it contains scarcely any water, as the brooks feeding it are all dried up by the prolonged drought. A thorough search is being made in the district for new temporary wells to tide over the emergency. If the existing service is further reduced, it will interfere with a good many factories, and render short time an absolute necessity. The streets cannot be watered or the sewers flushed. At Heywood, the continued dry weather is having a very serious effect on the water supply, upon which are dependent about 60,000 people; and the Corporation have issued notices warning the tradespeople to exercise the greatest caution, and prohibiting under penalties the washing of flagstones and windows and the watering of gardens. The reservoirs are very low; but, notwithstanding, the Corporation have by Act of Parliament to supply a million gallons of water daily to riparian owners.

At Devonport, the condition of the leat which supplies the town is lower than it has been for a quarter of a century. The Engineer of the Water Company (Mr. H. Francis, Assoc.M.Inst.C.E.) is doing everything to husband the resources at his command and to minimize the inconvenience naturally felt as the result of the prolonged drought. A return which has been kept of the rainfall in the Princetown district, from which the supply is derived, shows that the average between Jan. 1 and July 1 from 1880 to 1895, both inclusive, was 29·42 inches, compared with 19·35 inches for the corresponding period this year. During the past 17 years, the average rainfall from January to July, registered at the reservoir at Stoke, has been 14·53 inches, whereas this year it has fallen to 7·84 inches; the next lowest rainfall recorded at this place during the first half of a year being in 1887, when it was 8·71 inches. At another of the stations which supply Devonport, the figures for the first six months this year record a rainfall of only 13·13 inches, against an average for the same period during the preceding 16 years of 22·85 inches. It will be seen, therefore, that this has been an altogether exceptionally dry year up to the present; and the effect has been, in the case of the Crownhill reservoir alone, to bring the storage down to between 7 and 8 feet, whereas if full there should be a depth of 22 feet. In addition to the Belliver reservoir at Roborough, the large one at Crownhill, and the third at Stoke, there are various covered tanks for supplying the War Office and Admiralty establishments; and these, of course, show a relative diminution. Notwithstanding persistent rumours to the contrary, there is no ground for apprehension; and, by economizing, consumers can themselves help to postpone the time when there will be any real cause for alarm.

In South Wales, a very serious state of things prevails. Last Tuesday, the water supply at Aberavon was practically exhausted. The storage was only equal to 6¼ million gallons; and this had dwindled down to barely 500,000 gallons, of which some portion was not available, as it could not be drawn from the reservoir. The daily consumption averages 200,000 gallons; but the water flowing into the main was only 10,000 gallons. At Briton Ferry, which usually receives its supply from the Neath reservoirs, water is at a premium. For washing purposes, it is being drawn from a well at the gas-works, and conveyed to the consumers in tanks. Thanks partly to the foresight exercised by Mr. E. C. Pole, the Manager of the Neath Water-Works, in shortening the supply early in the season of drought, the inhabitants there still have water turned on for not less than an hour a day. The springs from which the town supply is obtained now yield 170,000 gallons in 24 hours. This quantity is supplemented by the pumping into the mains of 70,000 gallons a day from the Eastland spring, and by the placing at the service of the public of a more excellent private supply. There has not been any rainfall affecting the town reservoirs since March 26. The driest year on record was 1887, with a rainfall of only 36·11 inches. The year 1886 was, however, a wet one, with a rainfall of 57·12 inches; and this replenished the springs for the strain of 1887. Last year was a dry one, with 40·90 inches of rainfall; but for the first six months of the present year the rainfall was only 11·78 inches. A new reservoir at Mosshouse Wood is now in course of erection. At Llanelly, there are at present 50 days' supply in the reservoir, allowing 50 gallons per head; but this might surely be brought down to 25 gallons to husband the resources. In the Rhondda Valley, with its population of 130,000, water has become very scarce. On the other hand, in the Barry district, there has been no necessity for unusual restrictions upon the extent of the supply to the householders; but the exercise of care has been enjoined. At Cardiff, there has been no need to shut off the water for trade purposes; but something will have to be done to check the waste which goes on in washing pavements. At Aberdare, where there is a supply for three weeks only, equally reckless waste of water goes on.

Gas v. Coal for Cooking.—At a meeting of the Lewes Guardians last Wednesday, the House Committee reported that the gas cooking-stove hired for the Workhouse had effected a saving of £10 a year as compared with the cost of coal.

THE NEW WATER-WORKS FOR SHEFFIELD.

The Water Committee and other members of the Sheffield Corporation, with the two chief officials of the water-works—Mr. E. M. Eaton, the Engineer, and Mr. W. Terrey, the Manager—paid a visit last Wednesday to the Langsett district, where a new reservoir is to be constructed. *En route* the party stopped at the bridge on the Deepcar Road, where it crosses the Ewden water, in order to allow Mr. Eaton an opportunity of describing the site of a reservoir that was intended to be made by the old Water Company, and to be known as the Moorhall and Broomhead reservoir. The site was purchased before the water-works became the possession of the Corporation; but the reservoir was not constructed—the prevention of waste and other methods adopted with the view of procuring an economical use of water rendering the supply sufficient. As a result of the contention of Barnsley, the Sheffield Corporation acquired the Langsett site; and they feel justified in constructing the reservoir there before touching the Moorhall and Broomhead one, which will probably not be needed for another fifteen years. Proceeding with their journey, the party went on to Stocksbridge; and there Mr. Eaton gave them some information as to the compensation reservoir, a suggested diversion of the main road, and other works which it is proposed to carry out in the neighbourhood. Leaving the conveyance at Langsett, the party walked down into the valley of the Little Don to the site of the new reservoir, the dimensions of which were given by Mr. Eaton, who stated, among other things, that at the embankment the water would be 103 feet deep, that Langsett is 867 feet above the sea-level, and that the water level in the reservoir will be about 710 feet above the sea. A visit was then paid to the Haggbrook reservoir, higher up the valley of the Little Don, which serves Barnsley. This reservoir has an embankment of 50 feet. Originally it was intended to make it higher; but the action taken by Sheffield before Parliament recently has enabled Barnsley to considerably lessen the cost of construction. Journeying to Bolsterstone, the Moorhall and Broomhead gathering-ground was inspected, after which the party returned to Sheffield. Langsett reservoir will be started as soon as possible. There is, however, some difficulty in getting possession of the land; and six months, or even longer, may elapse before the scheme can be commenced. It will take four or five years to construct the reservoir.

THE CRAY WATER SCHEME OF THE SWANSEA CORPORATION.

The members of the Corporation of Swansea, last Friday week, paid a visit to the scene of the proposed water-works at Cray; and, while on the spot, they received from the Chairman of the Water Committee (Alderman J. Naysmith) and the Borough Engineer (Mr. Wyrill) some general information as to the scheme. It is expected that it will cost something under £300,000; and this will increase the storage capacity available for Swansea by 1000 million gallons. For this purpose, a large reservoir is to be constructed. At the Swansea end, it will have a tunnel running from the bottom of the lake, through the hill and into the Swansea Valley—a distance of 2½ miles. At the Cray end will be the dam, about 1240 feet long, 70 feet broad at the foundation, and narrowing up to 15 feet at the top. The foundation will be laid 15 feet in the solid rock; and the dam, which will be of masonry, will be 80 feet above the water-level. There will be 27 miles of piping, most of which has already been laid by Messrs. Aird. There will be two service reservoirs, one at Kilvey and the other at Town Hill; these being about 400 feet lower than the great reservoir at Cray. The rainfall in the Cray watershed is remarkable. Last year was not extraordinary in regard to rainfall—in fact, it was considerably below the average. Yet at Cray in 1895 the gauge near the top of the valley registered 86·57 inches, and lower down 63·47 inches, or an average of 70 inches. On one of the days of last year, the streams were so flooded that 750 million gallons of water passed down them in 24 hours, which would mean three-fourths the total storage capacity of the reservoir. As to the quality of the water, it has been submitted to every possible test, and is pronounced to be equal to, if not better than, any water in the kingdom.

There has been much discussion in the municipal chamber as to the appointment of a Consulting Engineer for the above scheme. The Water Committee recommended the engagement of Mr. G. H. Hill upon certain terms laid down by that gentleman, one of which was that he should appoint the Resident Engineer. This condition has provoked considerable opposition; but, at the meeting of the Council on Wednesday, the Committee's proposal was adopted by 19 votes to 14. There were, however, several members absent; and a motion to rescind the resolution will appear on the *agenda* at the next meeting.

Enrichment by Oil at Smethwick.—The Gas Committee of the Smethwick District Council have decided to introduce the oil process of enrichment; the saving being estimated by the Manager (Mr. B. W. Smith) at 1·33d. per 1000 cubic feet of gas made.

The Water Supply of Sutton, near Runcorn.—Last Wednesday, Mr. R. H. Bicknell held an inquiry, on behalf of the Local Government Board, into an application by the Runcorn Rural District Council for sanction to borrow £800 for the purpose of a water supply for the township of Sutton, near Runcorn. Mr. J. Ashton, Clerk to the Council, said the proposed supply was to be obtained partly from the Vyrnwy main of the Liverpool Corporation and partly from the Frodsham Water-Works. The estimated cost of construction of the necessary works was £1173 9s. 6d.; but of this sum Mr. H. Talbot, owner of most of the property in the township, was willing to contribute £400. The Liverpool supply would cost 9d. per 1000 gallons, and the Frodsham supply 1s. per 1000 gallons for the first 10,000 gallons per quarter, and 9d. per 1000 gallons for all in excess of that quantity.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week Scotland has been *en fête*, and Scotchmen everywhere have been in a state of high enthusiasm, over the fact that on the 21st of July a hundred years ago Robert Burns, the great Scottish poet, passed from this world. This week also the North British Association of Gas Managers held their annual meeting, and transacted certain business. There may not appear to be much relation between the two events; and neither is there by comparison. But contrast arouses reflection. Where the two events touch lies in the fact that Burns and William Murdoch came near to each other. Burns was born in the neighbourhood of Ayr, in 1759; and five years before that Murdoch first saw the light of this world at Old Cumnock, not twenty miles off. The county of Ayr has thus the merit of having given to Scotland two of her greatest sons. It is highly probable that the two met; for in both instances genius asserted itself early. Their paths were divergent—about as much as it was possible for them to be. The younger one devoted himself to literature; and in the course of a short career, which terminated abruptly at 37 years of age, he produced much fine writing, in poems, songs, and correspondence. The elder one devoted himself to more substantial labours in the physical world; and in a long lifetime, extending to 85 years, he did much to leave the world a more comfortable place to live in than he found it. His discovery of coal gas was the greatest of all his works. What it has done for mankind, I do not need to dwell upon here; but I may point out that Burns's works, however excellent in themselves, are necessarily confined in their influence to people who speak the Scotch dialect, whereas Murdoch's discovery is now of universal application. For every one who may obtain a sentimental benefit by perusing the works of Burns, probably a million derive tangible benefit by the use of coal gas. There is no comparison between the magnitude or the importance of the work of the two contemporaries; that of Murdoch is a mountain, and that of Burns is a mole-hill. Yet how does the world treat the memories of the two men? and how does Scotland treat them? At Dumfries, on Tuesday, 50,000 persons assembled to do honour to Burns; hundreds of wreaths, some from the most distant of our colonies, were laid upon his tomb; and one of our leading statesmen delivered a panegyric on his life and work. Demonstrations were also held in other parts of the country; and statues to his honour have been, or are being, erected in many places. At Edinburgh, on Wednesday, the North British Association of Gas Managers had before them the report of a Committee who have been, for at least ten years, collecting subscriptions for the establishment of a permanent memorial to Murdoch. This Committee four years ago placed a bust of Murdoch in the Wallace Monument at Stirling, and then aimed at raising £500 wherewith to found a bursary in Glasgow University. Despite their efforts, the fund has practically remained stationary; and now it has been resolved to close the movement, and Murdoch will be commemorated by the bust at Stirling and by a gas-engine in one of the laboratories of Glasgow University. The community have been apathetic; and the Association could do no more. This is quite in keeping with experience otherwise. Trifles light as air are not infrequently elevated into first place; while things which are solid and substantial, which can be seen and handled, are either passed by or taken as matter of course. Imagination is superior to reason. That which is undying is the fanciful, the unreal. Truths, which are real, are liable to be forgotten. Benefactions, which are also real, are accepted so long as they are useful, but without gratitude to the benefactor, whose name ceases to be connected with them. In the case with which I am dealing, the works and the name of the author live indissolubly connected with each other; the other man's works live, but the author is forgotten. It is human nature, and cannot be altered. It is a pity, however, that Murdoch's name is not to be better kept alive; and the hope may be expressed that the report to next year's meeting of the North British Association may not be the final one, as is intended.

The meeting of the Association was a large one as regards numbers, and an average one as regards quality. In the first place, there were too many papers on the programme. Three, or at most four, papers are quite enough for a day's work, if justice is to be done them. When there are more, discussions are hurried and incomplete. For instance, not to go over in detail the subjects which were before the meeting, could anything be more unsatisfactory than the discussion upon Mr. Forbes Waddell's paper? Though it was nominally on the plant in the retort-house at Forfar, it was really upon the accident which took place there. The subject naturally divided itself into two questions: First, whether the plant was such as might reasonably be employed at Forfar; and, second, whether there was anything in the evidence which would reasonably point to the accident having been caused by a defect in the plant. If the first of these were answered in the affirmative, and the second in the negative, the only conclusion possible would have been that the accident was caused by outside interference, with which the Association would have nothing to do—the matter would be one for inquiry by the criminal authorities. If the first question were answered in the negative, the second would almost follow in the affirmative, in which event there would be blame upon Mr. Waddell. The Association dealt with the subject as one; and the remarks of the gentlemen who spoke were decidedly favourable to Mr. Waddell. The conclusion which may be drawn from the discussion was in accordance with what I foreshadowed immediately after the inquiry *—that the accident was caused by foul play. If the object in bringing the subject forward were to have some authoritative pronouncement as to the cause of the accident, it was not accomplished, and, indeed, could not have been at an open meeting, without more careful consideration; and this consideration could only be given by a Committee—the Association Research Committee, for instance.

* See "JOURNAL," Vol. LXVII., p. 190.

The remark above, that the meeting was an average one, may be taken exception to; and therefore it may be advisable to deal with this question. In the first place, the programme was not, on the face of it, a very good one. There were two practical papers—Mr. O'Connor's and Mr. Waddell's; there was one scientific—Mr. Young's; there was one which was of the nature of an essay—Mr. M'Gilchrist's; and there was one—Mr. Ballantyne's—which might have been a practical one, but which, as I understood it, was more of an illustrated lecture. This classification would lead to the expectation that the provision would be sufficiently varied to suit all tastes; but the subjects were not all such as required heavy thinking. Mr. O'Connor's communication was a description of plant, and was quite interesting; but it required, from the nature of it, nothing more than to be listened to. Mr. Young's paper provided a good subject for discussion—the best on the card; but he could not be present, and the discussion brought out nothing new. That by Mr. Waddell is dealt with above. Mr. M'Gilchrist's paper was one which could not be, and was not, discussed; and Mr. Ballantyne's communication, while it did not give promise of affording much discussion, would, if there had been time, most probably have led to the best of the day. But, in the second place—and what struck me as most significant before the meeting, and which was accentuated by what occurred—with the exception of Mr. Waddell's paper there was nothing personal; and in this case it was too personal to be pleasant. As a matter of fact, outside the President's address there was not, in any of the papers, a single figure given as to results obtained in working. In the third place, too many of the leading members of the Association were either not present or took no part in the proceedings. This is a weakness of the Association which I deplore; and I have no doubt so do those who are at the head of affairs. Some reference was made to the statements in this column several weeks ago as to the standing of Scotland in the gas industry. Apparently a misconception was put upon my remarks; for they were not intended to depreciate gas managers in Scotland. On the contrary, the point of my argument was directed against those who are "advancing" beyond gas making, who know everything in theory, but nothing by practice. I hold that meetings such as the North British should be largely practical, with personal experience thrown in; and that even at meetings of the higher institutions, there should be room for practical work being discussed. But I do not go further into the matter. The Edinburgh meeting, though not a brilliant one, was quite passable as to merit; and as to other qualities, it was perfectly enjoyable. I am more concerned with the future of the Association than with this week's gathering. Its best members are either resigning, or do not attend. This is bad enough; but there is worse, in abstention from joining. These two movements are like the burning of the candle at both ends; and we know the result of this operation. I can see a crisis looming in the near future; and if the early pointing out of it will avert evil times, I will be glad at having written these sentences. Before leaving the meeting, I desire to say that I thoroughly agree with the remarks which were made regarding Mr. Carlow's conduct of the secretaryship. No more attentive official could be found.

I have not yet received a full account of the finances of the Paisley Gas Commissioners; but a short statement has been issued, from which it appears that for the year ending May last the gross revenue was £40,185, and the gross expenditure £31,805—the balance of profit and loss being £8380. After providing for interest on mortgages, and carrying £587 to the sinking fund, there was a net surplus on the year's transactions of £5544. The average illuminating power of the gas supplied during the year was equal to 27·02 standard candles; and the charge was 2s. 6d. per 1000 cubic feet to ordinary consumers, and 2s. 2d. to the Police Commissioners for public lamps. The statement was adopted at a meeting of the Commissioners on Wednesday; and it was agreed to meet on an early date to allocate the surplus and fix the price of gas. The balance from last year's account was £18,884, from which £7421 was paid in grants for special purposes—such as painting the Town Hall and purchasing the East-End Park. There was left £11,463; and adding thereto the surplus from the past year, there is a sum at the credit of profit and loss, as at May 28 last, of £17,007. No important extension, the Convener reported, had been made to the manufacturing plant during the past year; but the works had, as usual, been maintained in sound condition and paid for out of revenue. The additions and improvements recently sanctioned by the Council were now in progress, and would be completed by the autumn.

The Greenock Gas Trust held their annual meeting on Tuesday. It was reported that during the year ending June 30, the expenditure had been £38,976, and the revenue £39,258; leaving a net balance of £281. The estimated net profit for the year was £2015; but this was calculated with the rate at 3s. 2½d. per 1000 cubic feet, whereas the Board afterwards reduced the price to 3s. Bailie M'Innes, the Convener of the Gas Commissioners, moved the adoption of the minutes of the Committee and the accounts. Several members asked explanations as to how the surplus had turned out so small; and the Bailie explained that it was owing to the reduction in the price of gas. He also stated that they had an increase in the output of gas amounting to 22 million cubic feet; and that, had it not been for the Peebles oil-gas process, they would have required 1200 tons more of cannel, which would have made their expenditure much larger. They had agreed with the Oil-Gas Enrichment Company to commute the royalty on the process, on very favourable terms. Then an extraordinary statement was made. Bailie M'Innes said that there had been, a day or two before, a stairhead coterie of Magistrates, who were apparently in league to destroy the oil process at the gas-works. He insisted that Mr. Stewart, their Manager, had been invited to attend a meeting of the Magistrates on Monday on the subject; and that he (Mr. Stewart) had been asked by a certain member of the Board to report against the process. Bailie M'Innes maintained that, but for this oil-gas process, the price of gas would be a great deal higher than it was at present. He certainly would not have to do with a Trust which was interfered with in the way that this coterie had done. It was a reflection on the members who were daily giving their services for the Gas Committee. Treasurer Anderson explained that Bailie M'Innes was under a misapprehension as to the circumstances of their meeting Mr. Stewart. Mr. Stewart had not been sent for. They had simply met him on the way down stairs, and had entered

into a general conversation with him; and in his hearing no such suggestion had been made. The other Magistrates in question confirmed Treasurer Anderson's statement. Bailie Mitchell said that he had been with Bailie M'Innes when Mr. Stewart made the statement of having been asked to attend the meeting of Magistrates, and of the remark about the oil-gas process being made when he met the Magistrates on the stair. The Provost then explained that Mr. Stewart had not been invited to attend the meeting; but an official had been sent for Mr. Chalmers, and Mr. Chalmers not being in Mr. Stewart was asked to come. Further discussion followed, and was only stopped by the Provost exercising his right and closing it. The minutes were adopted; but the balance-sheet was, on the motion of Treasurer Anderson, remitted back to the Gas Committee for further elucidation of several items.

It was reported, at a meeting of the Forfar Gas Corporation on Monday, that there is a deficit on the working for the past year of £174. The accounts have not yet been issued; but I understand the deficit has arisen through the working during the time that Mr. Waddell was absent through illness after his accident.

The report of the Directors of the Coatbridge Gas Company for the half year ending June 30 last, which will be presented at the meeting of shareholders on the 6th prox., states that the consumption of gas is still on the increase—being in that period greater by 2,681,446 cubic feet than it was in the corresponding half of 1895. The total revenue was £6032; and the profit, £1897. Adding the balance of £723, there is a total of £2620. Deducting the amounts paid for interest and transferred to the reserve fund account, there is left £1752, the amount required to meet the maximum dividends at the rates of 10 and 7 per cent., payment of which will be recommended. Under the supervision of the Manager and Secretary (Mr. Thomas Wilson), the works and plant have been maintained in a thoroughly efficient state.

The Newport (Fifeshire) Gas Company, finding that there was a deficiency in gasholder accommodation, have, after consultation with Mr. J. M'Crae, of Dundee, and subject to the approval of the shareholders, fenced 1½ acres of ground, upon which they propose at present to erect a gasholder, and to which they look forward to later on removing the entire works. This, however, will not take place till the consumption of gas is double what it is at present.

The Penicuik Gas Company have paid a dividend at the rate of 5 per cent., carrying forward £416; and they have reduced the price of gas from 5s. 5d. to 5s. per 1000 cubic feet.

The Gas Commissioners of North Berwick had last year an income of £2487, of which £2305 was derived from the sale of gas, £67 6s. from coke, and £104 from tar. The expenditure amounted to £1946; leaving a balance of £541. A sum of £210 has been set aside for depreciation. The capital account amounts to £6541. The Commissioners have instructed the Manager to endeavour to secure second-hand purifiers of a larger size than those at present in use.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 25.

Sulphate of Ammonia.—The tendency of the market is still in the downward direction. Demand has been moderate, but mainly for covering purposes; consumers being altogether indifferent. Scotland is the weakest point—supplies being ample; and the depression has been accentuated by pressure to dispose of second-hand parcels. In England, sellers are having to partly adjust their prices to the Scotch level. The quotations are £7 13s. 9d. Leith, £7 17s. 6d. Hull, and £8 f.o.b. Liverpool. Over the next few months, speculators are offering on the basis of prompt prices, and up to the end of the year at a very trifling premium. There has been a certain amount of buying in the forward position. But the effect of these continually lower quotations is to thoroughly demoralize buyers; and they consequently hardly know what to do.

Nitrate of Soda remains firm at 8s. per cwt. for fine quality. In the forward position, the market is unchanged.

LONDON, *July* 25.

Tar Products.—There is a good inquiry for solvent naphtha, which appears to be scarce for the moment, and a better demand is also shown for crude naphtha, which does not respond to the improved values of benzols; but it is now dearer. There is no new feature in connection with pitch, the price of which is still doubtful; but at 32s. east-coast ports, it might be possible to find buyers. Distillers, however, are speaking of much higher prices; and, not being pressed by stocks, they show no particular interest in the article. Naphthalene in its various forms continues to move off freely. Benzols, though not quite so brisk, are firm at prices quoted below. There is nothing doing in anthracene; and prices mentioned are nominal. Speculative prices continue to be paid for tar; but, if pitch does not hold its own, the value of tar must go down. Carbolic acid is moderately firm; but buyers do not appear urgent, although the disinfecting season is now at its height.

The following prices represent transactions noted during the week: Tar, 19s. 6d. to 26s. Pitch, 32s. Benzols, 90's 3s.; 50's 2s. 6d. Toluol, 2s. 3d. Solvent naphtha, 1s. 4d. Crude, 30 per cent., naphtha, 10½d. to 11½d. Creosote, 1½d.; fluid, 2½d. Naphthalene, pressed, £3 5s.; salts, 32s. 6d. Cresylic acid, 1s. Carbolic acid, 60's, 2s. 1½d. Anthracene, "A," 10½d.; "B," 8½d.

Sulphate of Ammonia.—No business of importance is being done, manufacturers preferring to put the small quantity now being made into stock, rather than accept the low prices which buyers are offering. £7 1s. for northern ports and £8 for southern and western ports, less 3½ per cent., continue to be the ruling prices, with gas liquor selling at 6s. to 7s.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 159).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Apl.	10½	Alliance & Dublin 10 p. c.	25½–26½	+½	3 19 3
100,000	10	"	7½	Do. 7 p. c.	17½–18½	+½	4 1 1
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	108–110	..	4 10 11
200,000	10	12 June	5	Belgrano (B. Ayres), Limited	10–11	..	4 10 11
100,000	Stck.	26 June	5	Do. 5 p. c. Deb. Stk	100–103	..	4 17 1
200,000	5	29 May	6½	Bombay, Limited	7⅞–8	+⅛	4 1 3
40,000	5	"	6½	Do. New, £4 paid	5⅝–6	..	4 6 8
380,000	Stck.	27 Feb.	12	Brentford Consolidated	290–295	..	4 1 4
210,000	"	"	9	Do. New	220–225	..	4 0 0
50,000	"	"	5	Do. 5 p. c. Pref.	—	..	—
159,375	"	12 June	4	Do. 4 p. c. Deb. Stock.	130–134	..	2 19 9
220,000	Stck.	27 Mar.	11	Brighton & Hove Original	247–252	+10	4 7 3
208,820	"	"	8	Do. A Ord. Stk.	190–195	..	4 2 0
933,500	Stck.	27 Feb.	5	Bristol, 5 p.c. max.	127–132	..	3 15 9
420,000	20	27 Mar.	11½	British	57–58	..	3 17 7
50,000	10	12 Mar.	11½	Bromley, Ordinary 10 p. c.	22½–23½	..	4 17 11
71,000	10	"	8½	Do. 7 p. c.	19–20	..	4 5 0
500,000	10	29 Apl.	5	Buenos Ayres (New) Limited	10–11	..	4 10 11
200,000	100	1 July	6	Do. 6 p. c. Deb.	100–105	..	5 14 3
150,000	20	15 July	8½	Cagliari, Limited	29–31*	..	5 6 5
100,000	10	29 May	8	Cape Town & District, Ltd.	17–18	..	4 8 11
50,000	50	2 May	6	Do. 6 p. c. 1st Mort.	58–60	..	5 0 0
550,000	Stck.	15 Apl.	13½	Commercial Old Stock	342–347	..	3 17 8
165,000	"	"	10½	Do. New do.	258–263	..	2 19 10
165,000	"	12 June	4½	Do. 4½ p. c. Deb. do.	149–152	..	2 19 2
800,000	Stck	12 June	13	Continental Union, Limited.	285–290	..	4 9 8
200,000	"	"	10	Do. 7 p. c. Pref.	220–225	..	4 8 11
51,600	Stck.	27 Feb.	14	Croydon Com'cial A 10 p. c.	—	..	—
157,500	"	"	11	Do. B 7 p. c.	—	..	—
535,000	Stck.	27 Feb.	5½	Crystal Palace Ord. 5 p.c. Stk	137–142	+2	3 13 2
60,000	"	"	5	Do. 5 p. c. Pref.	—	..	—
486,090	10	15 July	11	European, Limited	26½–27½*	..	4 0 0
354,060	10	"	11	Do. £7 10s. paid	17⅞–18½*	..	4 9 3
5,746,590	Stck.	13 Feb.	12¾	Gaslight & Coke, A, Ordinary	320–325	+5	3 18 11
100,000	"	"	4	Do. B, 4 p. c. max.	110–115	+2	3 9 7
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	305–315	+10½	3 3 6
30,000	"	"	5	Do. F, 5 p. c. Prf.	150–155	+5	3 4 6
60,000	"	"	7½	Do. G, 7½ p. c. do.	215–220	+5	3 8 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	208–213	..	3 5 9
463,000	"	"	10	Do. J, 10 p. c. Prf.	305–315	+12½	3 3 6
476,000	"	"	6	Do. K, 6 p. c. Prf.	175–180	+3	3 6 8
1,061,150	"	12 June	4	Do. 4 p. c. Deb. Stk.	138–143	..	2 15 11
294,850	"	"	4½	Do. 4½ p. c. do.	153–158	+5	2 16 11
908,000	"	"	6	Do. 6 p. c. do.	207–212	..	2 16 7
70,000	10	14 May	6	Hongkong & China, Limited	12½–13½	..	4 8 10
3,800,000	Stck.	14 May	12	Imperial Continental	253–258	..	4 13 0
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100–103	..	3 17 8
473,600	Stck.	13 Feb.	3½	Do. 3½ p. c. Deb. Stk	110–112	+1	3 2 6

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	6–6½	..	4 12 4
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	115–118	..	4 4 10
250,000	100	"	4½	Do. 4½ p. c. Debs.	110–112	..	4 0
541,920	20	12 June	5	Monte Video, Limited	16¾–17½	..	5 14 3
150,000	5	29 May	8	Oriental, Limited	8¼–8½	..	4 11 5
135,000	5	"	8	Do. New, £4 10s. paid	7¼–7½	..	4 12 10
15,000	5	"	8	Do. do. 1879, £1 paid	1–2	..	4 0 0
60,000	5	12 Mar.	7	Ottoman, Limited	5–5½	..	6 7 3
166,870	10	—	2	Para, Limited	1¼–1⅝	..	—
420,000	100	1 May	6	People's Gas } 1st Mtg. Bds.,	105–110	..	5 9 1
500,000	100	1 June	6	of Chicago } 2nd Do.	102–107	..	5 12 1
250,000	10	27 Mar.	8	San Paulo, Limited	13–14	..	5 14 3
500,000	Stck.	13 Feb.	15½	South Metropolitan, A Stock	410–420	..	3 13 9
1,350,000	"	"	12	Do. B do.	320–330	+5½	3 12 9
310,000	"	"	13	Do. C do.	340–350	+4½	3 14 3
820,009	"	15 July	5	Do. 5 p. c. Deb. Stk.	173–176*	..	2 16 10
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	250–255	..	4 10 2
60,000	"	"	8½	Do. B	—	..	—
170,380	10	29 May	10	Tuscan, Limited	13¾–14½	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	98–100	..	5 0 0

WATER COMPANIES.

746,123	Stck.	26 June	10½	Chelsea, Ordinary	345–350	..	2 18 7
150,000	"	"	5	Do. 5 p. c. Pref.	170–175	..	2 17 1
160,000	"	"	4½	Do. 4½ p. c. Pref. Stk., 1875	—	..	—
175,785	"	27 Mar.	4½	Do. 4½ p. c. Deb. Stock	158–163	..	2 15 2
1,719,514	Stck.	15 Apl.	7	East London, Ordinary	238–243	..	2 17 8
654,740	"	26 June	4½	Do. 4½ p. c. Deb. Stk.	156–159	..	2 16 7
100,000	"	"	3	Do. 3 p. c. Deb. Stk.	104–106	..	2 16 7
700,000	50	12 June	7½	Grand Junction, 10 p.c. max.	123–127	..	2 19 0
280,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	149–153	..	2 12 4
708,000	Stck.	13 Feb.	12	Kent	352–357	..	3 7 3
160,000	"	"	7	Do. New, 7 p. c. max.	222–227	..	3 1 8
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	272–277	..	2 13 11
406,200	100	"	7½	Do. 7½ p. c. max.	227–230	..	3 5 2
350,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	147–152	..	2 12 8
500,000	100	13 Feb.	12¾	New River, New Shares	439–444	..	2 17 6
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk.	157–160	..	2 10 0
902,300	Stck.	12 June	4	S'thwk & V'xhall, Ordinary	158–163	..	2 9 1
126,500	100	"	4	Do. Do. 7½ p. c. Max.	153–163	..	2 9 1
489,200	Stck.	"	5	Do. Do. 5 p. c. Pref.	167–174	..	2 18 1
1,019,585	"	15 Apl.	4	Do. 4 p. c. A Deb. Stk.	147–152	..	2 12 8
1,155,066	Stck.	12 June	10	West Middlesex	327–332	..	3 0 2
200,000	"	"	4½	Do. 4½ p. c. Deb. Stk.	157–162	..	2 15 6

*Ex div.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Except that groundless fears on the part of the public as to the possibility of another general wages conflict in the coal trade have, during the past fortnight, brought forward quite a pressure of orders, there is no really material change as regards the actual condition. The buying just now going on in house-fire coals is simply what would ordinarily have come forward in the autumn; and the only result will be that, with consumers covering winter requirements a couple of months earlier than usual, trade will necessarily be exceptionally quiet towards the close of the year. For the present, pits are mostly kept on about full time, and prices are firm at list rates; but it is very exceptional where any actual advance has been put on. Best Wigan Arley still averages 10s. per ton; and Pemberton four-feet and seconds Arley, from 8s. up to 9s. Shipping prices continue quite as low as ever; and business is extremely slow.

Northern Coal Trade.—There has been more activity in the coal trade in the last few days; and all the steam coal collieries are now working fully, while the gas coal collieries have also received a slighter impetus. In regard to gas coals, there have been some increases in the demand for supplies; and it seems to be evident that stocking of coal is taking place a little earlier this year—possibly in view of expected labour troubles in the Midlands. There have been no contracts of moment booked this week; and any single cargoes of coals are at prices that average about 6s. 6d. per ton f.o.b. Gas coke is unaltered in price this week, but is in rather larger supply. Considerable quantities, however, are being used in the cement and other river manufactories; so that it is believed the stocks are not increasing.

Scotch Coal Trade.—On account of the holiday in Glasgow, the coal market has been at a stand-still; and no quotations can be given. The shipments amounted to 166,981 tons—a decrease on the preceding week of 1966 tons, but an increase on the corresponding period of last year of 34,706 tons. For the year to date, the shipments have amounted to 3,997,466 tons—an increase over last year of 242,460 tons.

Colne Valley Water Company.—At the meeting of the shareholders of this Company to be held at Bushey on the 1st prox., the Directors will report that the profit on the revenue account in the six months ending June 30 last was £5141, as compared with £4230 in the corresponding period of 1895. Adding the amount carried forward (£125), there will be £5266 to the credit of the dividend and interest account. After paying the interest on the debenture stock and preference shares, transferring £250 to the old engine suspense account, and £163 to the reserve account, there will remain £3410, from which it is proposed to pay a dividend at the rate of 4 per cent. per annum, less income-tax; leaving £425 to be carried forward. During the past half year, £8702 was expended on capital account, the greater part of which was in connection with the new engine and softening-tank.

Workmen's Testimony in Accidents.—During an inquest held in connection with the death of Charles Herl, 33, a hammerman, in the employ of the South Metropolitan Gas Company, who died from injuries received as long ago as October, 1894, it transpired that a fellow-workman of the deceased took down his statement to the effect that he alone was to blame. Herl was ascending a ladder for the purpose of taking some tools into a retort-house, when he slipped and fell into a coke-hole, sustaining a fractured spine. The Coroner (Mr. Braxton Hicks) remarked that if the comrades of men who were unfortunate enough to receive injuries while at work would adopt the same plan as had been carried out in this case, there would be much less friction between masters and men than there was. The jury returned a verdict of "Accidental death."

Gas-Meter Testing at Birmingham.—The Justices of the City of Birmingham having informed the Gas Committee of the Corporation that the large increase in the number of meters submitted to them for official testing renders it necessary that further accommodation shall be provided for the work, the Committee will to-day recommend the Council to erect a building for the purpose, at a cost of about £1450, in which provision will also be made for the testing of the illuminating power of the gas. The Justices will accept a tenancy of the portion of the buildings erected for their use, and will pay an annual rent based on the ground rent of 1s. 3d. per square yard on about 500 square yards; being that portion of the area which will not be required by the Gas Department, and 4 per cent. per annum on the cost of the portion of the buildings used by them.

Proposed Purchase of the Devonport Water Undertaking by the Corporation.—For some time the Devonport Corporation have had under consideration the question of the acquisition of the undertaking of the Devonport Water Company; and a few months ago they approached the Company with a view to ascertaining whether or not they were disposed to sell. At the last meeting of the Town Council, the Committee who had had the matter under consideration reported that they had received a letter from Mr. F. J. Bone, the Secretary to the Company, stating that the Directors were not disposed to enter into negotiations for the purchase of the property by agreement. On the suggestion of the Committee, it was decided to engage the assistance of an experienced water engineer, with a view to his reporting definitely at an early date upon the question of the compulsory purchase of the undertaking. Since this took place, the action of the Corporation has received the support of the local Mercantile Association. One of the speakers at the meeting of this body stated that, when the Company went to Parliament some years ago, their capital stood at £80,000, and powers were acquired to increase it by £40,000 for the purpose of constructing reservoirs and filter-beds. Subsequently they obtained further borrowing powers, which raised the capital to £160,000. It was thought by the gentleman who made this statement, that this £160,000 would be about the basis of negotiation between the Corporation and the Company; but others thought the purchase price would be nearer £300,000 than £160,000.

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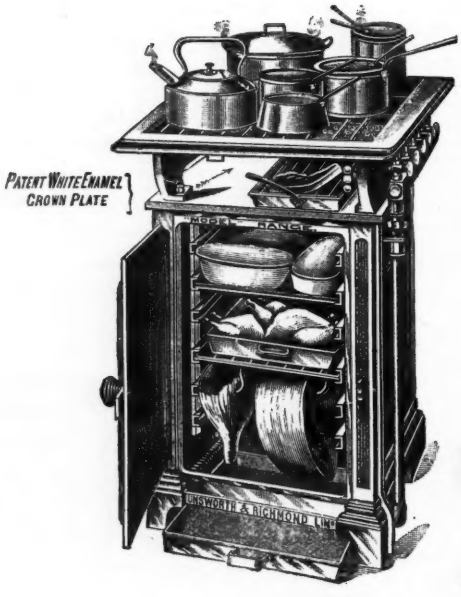
WARRINGTON & LONDON.



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HYDRAULIC AND GAS ENGINEERS,

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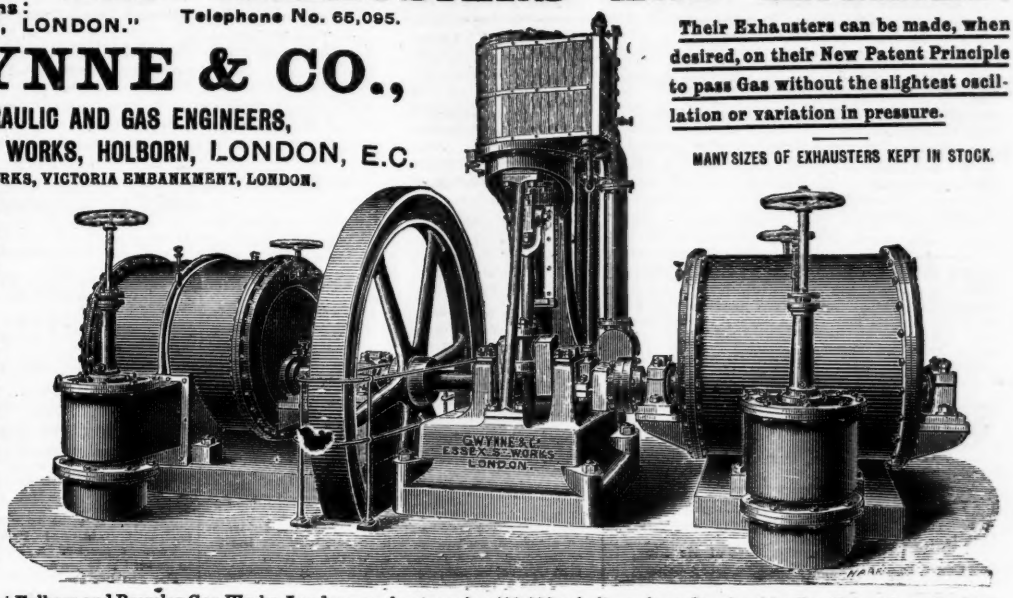
Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



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MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

BANK HOLIDAY.

NOTICE TO ADVERTISERS.—In consequence of the BANK HOLIDAY, orders with respect to ADVERTISEMENTS shou'd be received at the Office *not later* than THE FIRST POST ON SATURDAY NEXT.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director,
Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works.

ANDREW STEPHENSON,
182, GRESHAM HOUSE,
OLD BROAD STREET,
LONDON, E.C.

Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 106, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

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JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making Kerosene, &c.
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Telegraphic Address: "Sadler, Middlesbrough."

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WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
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NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
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THE RELIANCE LUBRICATING OIL COMPANY SUPPLY on APPROVAL "RELIANCE" NON-CORROSIVE LUBRICANTS (which, through their superiority, have the largest sale in the world)—viz., Engine, Cylinder, and Machinery Oils, 11½d.; Spindle Oil, 8½d.; Gas-Engine and Dynamo Oils, 1s. 6d. per gallon; Barrels Free and Carriage Paid. Also Liquids for Gas Making, Enriching, &c.
RELIANCE LUBRICATING OIL COMPANY, WATER LANE, GREAT TOWER, LONDON, E.C.
Depôts at Liverpool, Bristol, Hull, Glasgow and Newcastle-on-Tyne. Telegrams: "Subastral, London."

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.
BALE & CO.'S Oxide of uniform quality. Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SPENT OXIDE Wanted.
J. HARDMAN, Milton, STAFFS.

SULPHURIC ACID for Sale (B. O. V. and R. O. V.) made from Spent Oxide.
J. HARDMAN, Chemical Works, Milton, STAFFS.

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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, or NEWTON GRANGE, NEWBATTLE, DALKEITH, SCOTLAND.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
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READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

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THE LAW GUARANTEE & TRUST SOCIETY, LD., GUARANTEES FIDELITY.

SEND for complete Prospectus containing Balance-Sheet, Copy of Policy, &c., &c. Mortgage, Debenture, License, and Contingency Insurance.
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ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
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PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application. 70, CHANCERY LANE, LONDON, W.C.

NOTICE OF REMOVAL.

R. ANDREWS, Practical Retort Setter, HAS REMOVED from Sugden Road, Lavender Hill, to 9, JESSICA ROAD, WANDSWORTH COMMON (West Side), LONDON, S.W.

ADVERTISER (age 40) Seeks Re-engagement as MANAGER of Small Works (Public or Private). Can fix Meters, and lay Services and Mains. Twenty years' experience.
Address No. 2688, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Gas Manager or ASSISTANT in Gas-Works. Four Years' Experience in Gas-Works. Five Years Assistant in Water Engineer's and Burgh Surveyor's Office, and Four Years in Mechanic's Shop. Good Draughtsman and Chemist. Highest References.
Address No. 2683, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Small Gas-Works, a good STOKER, used to Shovel Work, and to make himself generally useful.
Apply to the MANAGER, Gas Company, Knighton, RADNORSHIRE.

WANTED, a Man for small Private Gas-Works and General House Work. Total Abstainer, and Single preferred.
Apply, by letter, to No. 2685, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WORKING Manager for a small Gas- Works Wanted (in August). House, Coal, and Gas to a suitable Man.
State lowest Wages (by letter) to No. 2687, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, for a small Gas- Works connected with a Factory, a good second-hand GASHOLDER, 16 feet to 18 feet diameter. Quotations and Specifications for new one also invited.
Apply to the CHEDDAR VALLEY MANUFACTURING COMPANY, Cheddar, SOMERSET.

WANTED, two or three good Stokers. Must be industrious and sober. Used to Shovel Charging, Engine and Exhauster. Constant Employment, if found suitable for the work. Wages 24s. 6d. per week.
Apply to JNO. CHURCH, Gas-Works, LYMINGTON.

TO METER MAKERS.

WANTED, a well qualified practical Man for Dry Meter Works now opening in London.
Address, stating Qualifications and Terms, to T. T., care of J. W. Vickers, 5, NICHOLAS LANE, E.C.

WANTED, for the Gas Department of a Corporation, an OUTDOOR SUPERINTENDENT to take the Supervision of Internal Fitting Work, Main and Service Laying, Fixing and Repairs of Cooking and Heating Stoves, &c.
Applicants to give References only, and to state Age and Experience.
Applications to be addressed No. 2686, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

URBAN DISTRICT COUNCIL OF LYMM.

TO GAS MANAGERS.

THE Urban District Council of Lymm desire to receive APPLICATIONS for the appointment of a WORKING MANAGER at their Gas-Works in Lymm, Cheshire.
The Manager will be required to enter upon his duties as soon as he is appointed.
For Particulars as to Remuneration, Duties, &c., apply in writing to the Clerk.
Applications in Candidate's own handwriting, stating Age and Qualifications, with *copies* of three recent Testimonials (which will not be returned) must be sent to the undersigned on or before the 4th day of August next, marked "Application for Gas Manager."
The Council reserve the right of rejecting all or any applications.

By order,
W. MULLARD,
Clerk to the Council.

Council Offices, Lymm,
July 24, 1896.

WANTED, a Second-hand Scrubber for small Gas-Works carbonizing 400 Tons of COAL per annum.
Particulars and Price to the SECRETARY, Gas Company, Fowey, CORNWALL.

PURIFIERS for Sale, owing to Alterations and Extensions in the Purifying Department at the Birkenhead Gas-Works—
Three Sets of four PURIFIERS, each Box being 14 feet square, and each set worked by a 14-inch Centre-Valve.
Also one set of two PURIFIERS, same size as above, worked with Two 20-inch Four-Way Valves and Connections.
The Purifiers may be seen upon application to Mr. T. O. Paterson, Gas-Works, Birkenhead; and further Particulars and Prices can be obtained from R. & J. DEMPSTER, LIMITED, Gas Plant Works, Newton Heath, MANCHESTER.

OFFERS Wanted for Shares and Debentures in William Sugg and Co., Limited also for SHARES in the Gas Purification and Chemical Company, Limited.
Address, J. P. LANT, Room 6, Law Courts, LONDON.

FOR SALE, very Cheap—Ten Volumes (equal to New) of "REPORTS OF ASSOCIATIONS OF GAS ENGINEERS AND MANAGERS, UNITED KINGDOM" (illustrated), 1886 to 1895. Five Volumes of "THE GAS INSTITUTE TRANSACTIONS," 1887 to 1891 (illustrated), and equal to new.
Apply to E. P., 119, Queen's Road, Finsbury Park, LONDON, N.

WIDNES CORPORATION GAS AND WATER WORKS.

GAS PLANT, &c., for Sale—Annular CONDENSER, MANN and WALKER TOWER SCRUBBER, 38 ft. by 8 ft., and a WALKER PURIFYING-MACHINE of 1 Million Cubic Feet capacity per diem. The Valves and Connections for the above are 12 inches diameter.
Particulars may be obtained on application to Mr. ISAAC CARR, Assoc.M.Inst.C.E., Gas-Works, WIDNES.

FOR SALE—One Rotary Engine and EXHAUSTER, to pass 35,000 cubic feet of Gas per Hour, with Governor, &c., complete. One DEMPSTER'S HORIZONTAL ENGINE and EXHAUSTER, with double Cylinder, to pass 35,000 cubic feet of Gas per Hour, with Governor Connections. Also about 360 feet of 18 in. by 18 in. HYDRAULIC MAIN, with 5-inch Stand-Pipes, Bridge-Pipes, Mouthpieces, &c.
The above are all in good condition, are suitable for smaller Gas-Works, and are being replaced by Apparatus of larger size.
The apparatus may be seen, or any further Information obtained, on application to Mr. William Smith, Gas Engineer, Lum Street Gas-Works, Bolton.
Gas Offices, Bolton,
June 2, 1896.

HOYLAKE AND WEST KIRBY GAS AND WATER COMPANY, LIMITED.

THE above Company have for Sale—
Two STATION METERS, 1200 cubic feet per hour, and 3600 cubic feet per hour, with Valves.
One 8-inch GOVERNOR, with Valves.
One 8-inch FOUR-WAY RACK-VALVE.
Two 8-inch FOUR-WAY CENTRE-VALVES.
Nine 20 in. by 14 in. ⌂ MOUTHPIECES.
Two Self-sealing MOUTHPIECES, 20 in. by 14 in.
HYDRAULIC MAIN, Wrought Iron, 14 in. by 14 in., suitable for three Beds of five Retorts.
Twelve 14 in. by 12 in. ⌂ MOUTHPIECES, with Lids and Screws complete.
Seventeen 4-inch H and DIP PIPES,
Fourteen ASCENSION-PIPES.
For further Particulars, apply to
JAMES DOUGALL,
Engineer and Manager.
Gas-Works, Hoylake,
July 25, 1896.

CORPORATION OF LEICESTER.

PURIFIER-GRIDS.

THE Gas and Electric Lighting Com- mittee of the above Corporation are prepared to receive TENDERS for the Supply and Fixing of GRIDS for five Purifiers, 32 feet square, at their Aylestone Road Works.
Specification and Form of Tender may be obtained upon application to the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Purifier-Grids," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, the 8th of August next.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Offices: Millstone Lane, Leicester,
July 20, 1896.

COMMERCIAL GAS COMPANY.

THE Directors of the Commercial Gas Company are prepared to receive TENDERS for the surplus BREEZE produced at their several Works for the Twelve Months ending the 31st of July, 1897.
The quantities are estimated to be as under, but the same cannot be guaranteed, and may be more or less:
At the Stepney Works, in the Regent's Canal—
2500 chaldrons (of 48 bushels) of Fine Coke Breeze, and
2500 chaldrons (of 48 bushels) of Rough Pan Breeze.
At the Wapping Works, on the River Thames—
2000 chaldrons (of 48 bushels) of Fine Coke Breeze, and
2000 chaldrons (of 48 bushels) of Rough Pan Breeze.
At the Poplar Works, in Bow Creek (free waterway)—
4000 chaldrons (of 48 bushels) of Fine Coke Breeze, and
4000 chaldrons (of 48 bushels) of Rough Pan Breeze.
The tenders may be for the whole or for one or more Works separately.
The Contractors must give security to remove the Breeze as it accumulates, to pay for the same monthly, and generally for the due fulfilment of the contract.
The form of agreement to be signed can be seen at the Company's Offices.
Tenders, sealed and endorsed "Tender for Breeze," to be delivered here not later than the 30th of July inst.
The Directors reserve to themselves the right to accept any tender in part or in whole, and do not bind themselves to accept the highest or any tender.
Commercial Gas-Works, Stepney, E.,
July 16, 1896.

HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD.

THE Gas Board invite Tenders for the surplus TAR and LIQUOR produced at their Works for Twelve Months from the 1st of August, 1896.
Full Particulars may be obtained on application to Mr. West, Manager, Crow Nest, Hebden Bridge.
Tenders, endorsed "Tar and Liquor," to be in the hands of the undersigned not later than Wednesday, the 5th of August, 1896.

RICHARD CRABTREE,
Clerk.

July 25, 1896.

THE Urban District Council of Hindley are prepared to receive TENDERS for one LIVESEY PATENT WASHER and TAR-EXTRACTOR, to pass 500,000 cubic feet of Gas in 24 hours, connected and fixed complete at their Gas-Works, Hindley.
For further Particulars, apply to Mr. Dickinson, Gas and Water Manager.
Sealed tenders, endorsed "Washer," to be lodged with the undersigned on or before Monday, Aug. 10, 1896.

By order,
STEPHEN HOLT,
Clerk to the Council.

Council Offices, Hindley,
July 24, 1896.

TENDERS FOR GAS COAL.

THE Directors of the Newark Gas Com- pany are prepared to receive TENDERS for the supply of 5000 Tons of best screened SOUTH YORKSHIRE GAS COAL, delivered at Newark, G.N.R., in such quantities as may be required during the ensuing Year from Sept. 1 next.
The Coal is to be delivered fresh wrought and free from Dirt, Bats, Shale, Pyrites, and other Impurities.
Tenders, marked on the outside "Tender for Coal," to be sent in to me on or before Aug. 13, 1896.
For Further Particulars, apply to
FREDK. B. FOOTTIT,
Secretary and Manager.
Newark, July 24, 1896.

BOROUGH OF NEWBURY.

THE Gas Committee of the Corporation of Newbury are prepared to receive TENDERS for the supply of 2500 Tons of best GAS COAL for the Ten Months ending July 31, 1897. Prices to include delivery to Newbury Station, G.W.R.
The Gas Committee do not bind themselves to accept the lowest or any tender.
All tenders should be posted not later than Friday, Aug. 7 next, and addressed "Chairman, Gas-Works Office, Newbury, Berks."

By order,
ROBERT M. COUPER,
Manager.

Gas-Works, Newbury,
July 25, 1896.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors in this Company, will be held at this Office on Friday, the 7th day of August next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 30th day of June last.
Notice is Hereby also Given, that at such Meeting the Directors will apply to the Proprietors for AUTHORITY, in pursuance of the powers of the Companies Act of 1876, TO RAISE FURTHER CAPITAL by the creation and issue of a Sum not exceeding £150,000 of new Ordinary Stock.
Notice is Hereby further Given, that at such Meeting the Directors will apply to the Proprietors for AUTHORITY TO DISPOSE of such FURTHER PORTION of the COMPANY'S PROPERTY as is not now required for the purposes of their Undertaking.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., July 21, 1896.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.
He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
Offices: 18, FINSBURY CIRCUS, E.C.

In Paper Cover, Price 1s.

GASHOLDERS
WITH OR WITHOUT
GUIDE-FRAMING.

A DISCUSSION
BETWEEN
E. LLOYD PEASE & F. SOUTHWELL CRIPPS.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED,

— *v* —

"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

— *v.* —

"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared VALID ON ALL POINTS after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a "PIONEER INVENTION."

SCOPE OF PATENT. The Patent HAS BEEN GIVEN A WIDE CONSTRUCTION; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), IS STILL AN INFRINGEMENT of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an INJUNCTION, WITH FULL COSTS, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given AGAINST the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the VALIDITY OF THE PLAINTIFFS' PATENT.

"SUNLIGHT" MANTLES. Last about 100 hours.

"WELSBACH" MANTLES. Last about 1000 hours.

"Sunlight" Mantles BURN DOUBLE THE GAS to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to REPLACE THEM BY THEIR OWN MANTLES.

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, IN ALL CASES, BE RIGOROUSLY ENFORCED.

INFRINGERS. The Incandescent Gas-Light Company WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT, WHETHER

MAKERS,
WHOLESALE DEALERS,
RETAILERS,
or
USERS.

Users of the Company's Mantles upon Burners not sold by the Company ARE INFRINGERS.

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

FAITHFULL & OWEN,
11, Victoria Street,
Westminster.

Solicitors to the Incandescent Gas-Light Company, Limited.

April, 1896.

NOTICE.

The attention of the METEOR INCANDESCENT LIGHTING COMPANY, LIMITED, having been again called to the Advertisements inserted in various papers by the Incandescent Gas-Light Company, Limited, of Palmer Street, Westminster, to the effect that the "Meteor" Incandescent Gas-Lights are an Infringement of their Patents, and that they will bring Actions for Infringement against all persons found dealing in any manner with such Lights, the METEOR INCANDESCENT LIGHTING COMPANY, LIMITED, HEREBY GIVE NOTICE that they are advised that the "Meteor" Incandescent Lights in no way infringe any of the Patents of the Incandescent Gas-Light Company, Limited, that an action has been commenced to restrain such threats, and that they are PREPARED TO FULLY INDEMNIFY ALL PURCHASERS, DEALERS, AGENTS, and USERS of their Lights against any Legal Proceedings on the part of the Incandescent Gas-Light Company, Limited.

WILSON, BRISTOWS, & CARPMAEL,
1, Copthall Buildings, London, E.C.,
Solicitors to the Meteor Incandescent Lighting Company, Limited, of 35, New Broad Street, London, E.C.

Nov. 30, 1895.

Price 5s. per 100.

THE USE OF

GAS LIME IN AGRICULTURE.

By Dr. A. VOELCKER.

A 4pp. Leaflet for Distribution among Farmers and others.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS.

By N. H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation; Condensation; and Purification.

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, $16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) $13\frac{3}{4}$ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . $13\frac{1}{2}$ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor $94\frac{1}{2}$ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 34, OLD BROAD ST., E.C.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.

8 Lombard Street,

NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,

165, QUEEN VICTORIA STREET, E.C.,

And at STROUD, GLOUCESTERSHIRE.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF

NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed,

Samples and Prices on application.

5, PRINCES STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

LITTLE & GRAHAM, LD.

THE
INCLINED RETORT
SPECIALISTS

TRANSPORT APPLIANCE WORKS,
SMETHWICK,
BIRMINGHAM.

ROBERT MARSHALL,
CANNEL COAL MERCHANT
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., LD.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895,*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c. apply to the

WEARDALE IRON & COAL Co., LD.

QUAYSIDE, NEWCASTLE-ON-TYNE.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

12, JOHN STREET, ADELPHI, LONDON W.C.

FACE YOUR RETORT MOUTHPIECES.

Main Drilling Gear with Drills, 1½ to 6 inch; Taps, Rymers, and Drills.

JOHN RUSCOE calls attention to his Retort Mouthpiece and Lid Facing Machines, which are in extensive use; also to his Lathes, Drilling, Slotting, Grooving and Planing Machines, Smiths' Hearths, Smithy Fans, Roots' Blowers; also special Screwing-Machines for Gas Tubes and Bolts, Taps, Wrenches, Pipe-Cutters; Special Taper and Twisted Rymers, Drills, &c.

Ratchet Screwing Stocks and adjustable once-up Stocks, Dies, Guides, &c.

For Prices, References, and other Particulars, apply to the Patentee and Manufacturer,

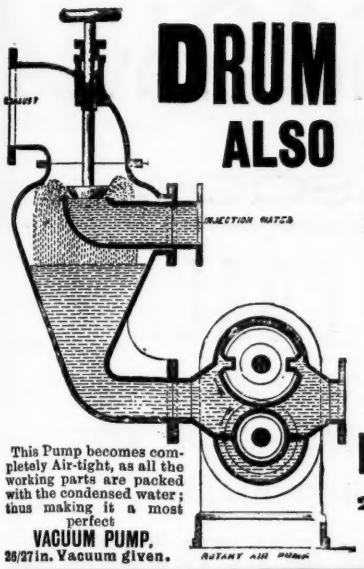
JOHN RUSCOE, ALBION WORKS, HYDE, near MANCHESTER.

"The Force of the Piston Pump with the Capacity of the Centrifugal combined."

JOHNSON'S PATENT

DRUM PUMP AND EXHAUSTER

ALSO VACUUM PUMP AND CONDENSER.



This Pump becomes completely Air-tight, as all the working parts are packed with the condensed water; thus making it a most perfect

VACUUM PUMP.

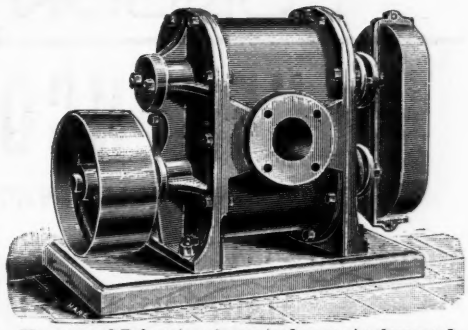
26/27in. Vacuum given.

No Priming, Valves, or Frictional Working Parts.

The Pump of the future for quickly and economically moving large Bodies of Water, Semi-fluid, &c.

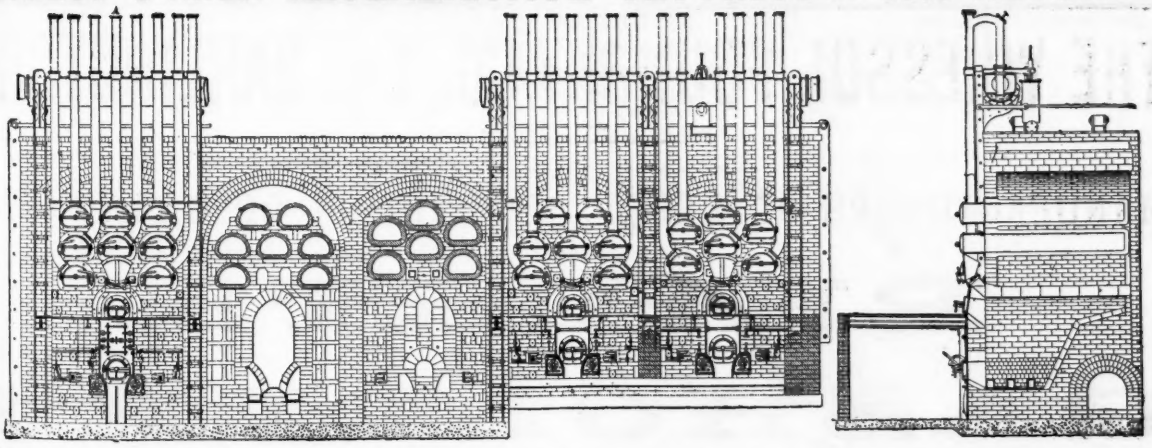
DRUM ENGINEERING Co.

27, CHARLES ST., BRADFORD.



Blowers and Exhausters guaranteed, even at a slow speed, to give a working pressure of 3 lbs. and upwards, and this without losing power by creating frictional Heat.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non.*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.

Further Information and Pamphlets from Principal Agent.

H. KIRKHAM'S
PATENT BASKET OR CAGE
FOR HOLDING MATERIAL IN SCRUBBER-WASHERS.

ADVANTAGES—Lightness; Cages removed, and fresh ones substituted in a few hours; Machines easily cleaned; No stopping for long periods; Saving in Labour and Power.

Full Particulars on application at 335, MANSION HOUSE CHAMBERS, 11, QUEEN VICTORIA ST., LONDON, E.C.

R. & A. MAIN,
GAS COOKING AND HEATING STOVES,
92, ALDERSGATE STREET, KINNING PARK,
LONDON, E.C., & GLASGOW.

HEATHCOTE GAS COAL.
RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.
THE GRASSMOOR Co., Ld., CHESTERFIELD.

THE WHESSOE FOUNDRY CO., LTD., DARLINGTON.
Established 1790.

MANUFACTURERS OF EVERY DESCRIPTION OF GAS PLANT,
FROM
RETORTS
TO
GASHOLDERS
FOR WHICH THEY HAVE THE NEWEST AND MOST MODERN MACHINERY.
GASHOLDERS CAN BE MADE OF ANY DIAMETER AND PUT TOGETHER AT THE WORKS.

Holders having a capacity of **8,000,000** Cubic Feet have been made and erected; the largest one being 181 feet diameter by 136 feet 9 inches deep. Riveted entirely with ⅞-inch diameter Hot Rivets.

WE ERECT GASHOLDERS EITHER WITH OR WITHOUT FRAMING.
NO ROYALTIES TO PAY FOR PATENTS.
SOLE MAKERS OF
COATES' IMPROVED PATENT FURNACE DOOR PROTECTOR,
Which has been approved and adopted by the Gas Authorities at
SALFORD, MANCHESTER, BIRKENHEAD, STOCKTON, NEWCASTLE, DARLINGTON, &c.

Telegraphic Addresses: "WHESSOE, DARLINGTON." "WHESSOE, LONDON." | T. COATES, MANAGING DIRECTOR. | WORKS: DARLINGTON. LONDON OFFICE: 28, QUEEN STREET, E.C.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

MESSRS. HUMPHREYS & GLASGOW

Have constructed their EUROPEAN type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Brighton	1,500,000 Cub. Ft.
Belfast	1,700,000 ,,	Preston	1,500,000 ,,
Glasgow	300,000 ,,	Southport	750,000 ,,
Brussels	700,000 ,,	Bath	1,000,000 ,,
Liverpool	3,500,000 ,,	New York	1,200,000 ,,
Tottenham	750,000 ,,	Newburgh, N.Y.	350,000 ,,
Santiago	400,000 ,,	Tottenham (Second Contract)	750,000 ,,
Swansea	750,000 ,,	St. Joseph, Mo.	750,000 ,,

And have now under Contract:—

Belfast (Second Contract)	4,500,000 Cub. Ft.	Edinburgh	2,000,000 Cub. Ft
Shanghai	225,000 ,,	Stockton-on-Tees	500,000 ,,
Winchester	200,000 ,,	Stockport	500,000 ,,
Hoylake	125,000 ,,	Norwich	1,000,000 ,,
Manchester	3,000,000 ,,	Guildford	350,000 ,,
Brussels (Second Contract)	700,000 ,,	Syracuse, N.Y.	850,000 ,,
Holyoke, Mass.	600,000 ,,	Bordentown, N.J.	125,000 ,,

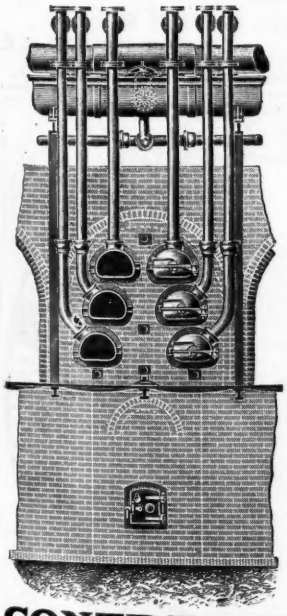
In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

9, Victoria Street, London, S.W.

Telegrams: "EPISTOLARY, LONDON."

United States Office, 64, Broadway, New York.

R. DEMPSTER & SONS, L.D.

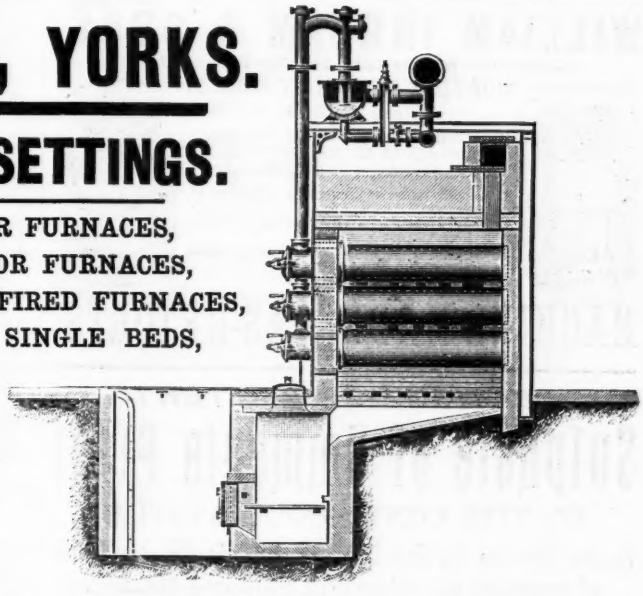


ELLAND, YORKS.

RETORT-SETTINGS.

GENERATOR FURNACES,
REGENERATOR FURNACES,
SIMPLE DIRECT-FIRED FURNACES,
THROUGH & SINGLE BEDS,
SUITABLE FOR

LARGE
OR
SMALL
GAS-WORKS.



CONTRACTS FOR COMPLETE INSTALLATIONS.

GIVING THE HIGHEST WORKING RESULTS, THE MOST PERFECT HEATING, GREATLY INCREASED DURABILITY, THE LOWEST FUEL CONSUMPTION.

PLANS AND ESTIMATES ON APPLICATION.

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.

STOURBRIDGE
RETORTS AND FIRE-BRICKS.
BEST QUALITY.

KING BROTHERS, STOURBRIDGE.
[See Illustrated Advertisement, July 7, p. 52.]

OXIDE OF IRON.
NATURAL BOG ORE FROM OWN MINES.
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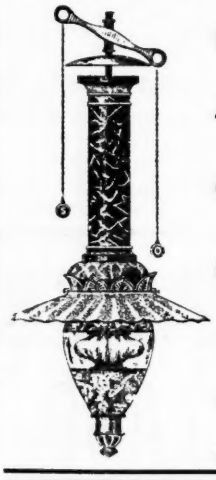

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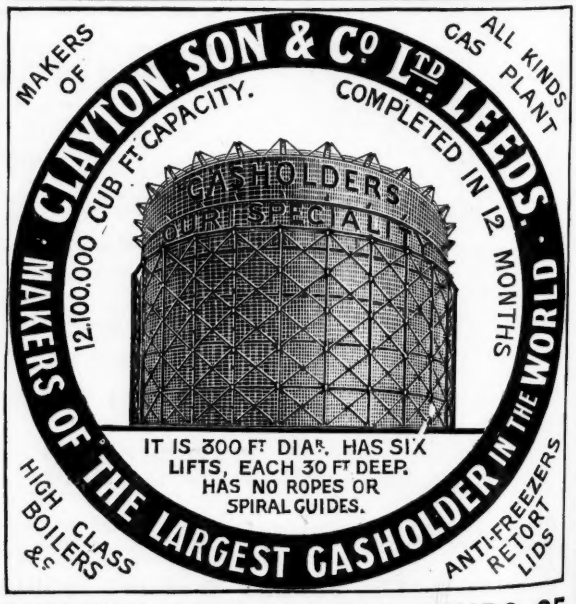
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[See also Advt. p. 154.

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